

HOIST FOR ELEVATOR AND ELEVATOR EQUIPMENT

Background of the Invention

The present invention relates to a hoist for an elevator including a brake device and to an elevator equipment.

As a hoist brake device for an elevator, there are known brakes of a direct driven type that transmit force of a braking spring to a braking member and presses the braking member against a member to be braked to brake the member to be braked (see, for example, JP-A-2002-533283 and JP-A-2006-161920). These brakes are brakes that press a brake shoe against a brake drum to apply braking to rotation. Since the brake shoe slides against the brake drum in order to apply braking, the brake shoe is periodically inspected and replaced.

10 Brief Summary of the Invention

A brake shoe includes a pad section that comes into contact with the member to be braked and a fixing section that fixes the pad section. For inspection and replacement of the brake shoe, it is necessary to adopt a structure for enabling the brake shoe to be detached from a brake device and attached to the brake device. However, for example, in the conventional
15 brake device disclosed in JP-A-2002-533283 and JP-A-2006-161920, the brake shoe cannot be inspected and replaced unless the brake device is detached from a setting portion when the brake shoe is replaced. This makes such work extremely complicated and time consuming.

Therefore, it is desired that the work can be performed more easily and in a short time. In particular, in recent years, there is an increasing demand for a machine room-less elevator in which a machine room is not provided and a hoist is provided in a hoistway. In such a machine
20 room-less elevator, since a space in which the machine room-less elevator is set is smaller compared with the machine room, a work space for performing maintenance work is also small and the brake device is mounted in a small space. Therefore, the attachment and the detachment of the brake shoe are difficult.

When the brake shoe is pressed against the brake drum, the brake shoe receives frictional force for moving, together with the brake drum, the brake shoe in a direction in which the brake drum rotates and reaction due to the pressing against the brake drum. Therefore, complicated force for twisting the brake shoe acts on the brake shoe. When it is attempted to adopt a structure for simplifying the attachment and the detachment of the brake shoe, it is
25 anticipated that, for example, the brake shoe is detached by these kinds of force and drops.
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However, as a safety device, the brake device is requested to have extremely high reliability. Therefore, it is necessary to secure stable braking performance for preventing such a situation.

The present invention has been devised in view of the problems and it is an object of the present invention to provide a hoist for an elevator and an elevator equipment including a structure for enabling easy attachment and detachment of a brake shoe while securing braking performance.

For achieving the above object, according to the invention, each of a hoist for elevator and an elevator equipment, comprises a motor having a body frame and an output shaft, a sheave mounted in the output shaft, a brake drum arranged coaxially with the sheave to be rotatable together with the sheave, a brake shoe capable of sliding on the brake drum to brake a rotation of the sheave, and a brake device connectable to the brake shoe so that the brake shoe is pressed by the brake device against the brake drum in a pressing direction, wherein the brake shoe is capable of being made connected to and disconnected from the brake device by rotating the brake shoe on an axis parallel to the pressing direction,

the hoist further comprises a brake shoe guide passage capable of receiving therein the brake shoe so that the brake shoe is restrained by the brake shoe guide passage from rotating on the axis, and a brake device shifting device through which the brake device and the body frame are connectable to each other so that the brake device is allowed by the brake device shifting device to be located at a first position where the brake shoe is arranged in the brake shoe guide passage when the brake device is connected to the brake shoe to be pressed against the brake drum and so that the brake device is located by the brake device shifting device at a second position where the brake shoe is arranged at the outside of the brake shoe guide passage to enable the brake shoe to be rotated on the axis when the brake shoe needs to be disconnected from the brake device.

According to the invention, each of the hoist for elevator and the elevator equipment wherein the brake shoe can be attached and detached easily with maintaining the braking performance, can be provided.

Brief Description of the Several Views of the Drawings

Fig. 1 is a schematic perspective view showing entire elevator equipment according to an embodiment of the present invention;

Fig. 2 is a sectional view of a hoistway showing a state of a device arrangement of the elevator equipment according to the embodiment of the present invention;

Fig. 3 is a front view of a hoist for an elevator according to the embodiment of the

present invention;

Fig. 4 is a front enlarged view showing a braking section during braking of the hoist for an elevator according to the embodiment of the present invention;

5 Figs. 5A and 5B are respective front and side views showing a brake shoe of the hoist for an elevator according to the embodiment of the present invention;

Figs. 6A and 6B are top views showing respective states during attachment and during detachment of the brake shoe of the hoist for an elevator according to the embodiment of the present invention;

10 Fig. 7 is a front enlarged view showing the braking section at normal time of the hoist for an elevator according to the embodiment of the present invention; and

Fig. 8 is a front enlarged view showing a state during detachment of the brake shoe of the hoist for an elevator according to the embodiment of the present invention.

Detailed Description of the Invention

15 The present invention is explained below by way of examples with reference to the accompanying drawings.

Fig. 1 is a schematic perspective view showing entire elevator equipment according to an embodiment of the present invention. Elevator equipment 1 shown in the figure includes a passenger car 3 and a balance weight 4 that move up and down in a hoistway 2, a main rope 5 that suspends the passenger car 3 and the balance weight 4, and a hoist 6 that
20 drives the main rope 5 and moves the passenger car 3 and the balance weight 4 up and down in opposite directions from each other.

Fig. 2 is a sectional view of a hoistway showing a state of a device arrangement of the elevator equipment according to the embodiment of the present invention. In the elevator equipment 1 according to this embodiment, the hoist 6 is arranged in parallel to the balance
25 weight 4 between the passenger car 3 and a hoistway wall in the hoistway 2. Since the hoist 6 in this embodiment is set between the passenger car 3 and the hoistway wall, the hoist 6 is a thin type in which axis direction length of an output shaft of a motor is smaller compared with a diameter of the motor. The hoist 6 incorporates a driving sheave 7 around which the main rope 5 is wound and a motor 8 that rotates the driving sheave 7. The hoist 6 includes a braking
30 section 9 that brakes a rotation of the driving sheave 7.

Fig. 3 is a front view of a hoist for an elevator according to the embodiment of the present invention. The hoist 6 includes a main body frame 10 incorporating the motor 8, the driving sheave 7 provided in a not-shown output shaft of the motor 8, and a brake drum 11 that is

provided concentrically with the driving sheave 7 and rotates together with the driving sheave 7.

In the hoist 6 in this embodiment, a pair of braking sections 9 are provided above and under the brake drum 11 to be opposed to the outer circumference of the brake drum 11.

Since the braking sections 9 are provided above and under the brake drum 11 in this way,

5 although a dimension in the longitudinal direction relatively having room as a setting space in the hoistway 2 is extended, the spread in the lateral direction not having room in terms of space can be suppressed. Therefore, it is possible to improve setting efficiency for devices of machine room-less elevator equipment and prevent an increase in an unnecessary hoistway sectional area.

10 The braking section 9 includes a brake shoe 12 that comes into slide contact with the brake drum 11 and brakes the rotation of the driving sheave 7 and a brake device 13 that presses the brake shoe 12 against the brake drum 11.

Fig. 4 is a front enlarged view showing the braking section during braking of the hoist for an elevator according to the embodiment of the present invention. As shown in Fig. 4,
15 the brake device 13 in this embodiment includes a fixed iron piece 14 and a movable iron piece 15. A rod 16 having a spherical distal end integrated with the movable iron piece 15 is inserted into the fixed iron piece 14. Braking springs 21 are provided between the fixed iron piece 14 and the movable iron piece 15. The braking springs 21 press, toward the brake drum 11, the movable iron piece 15, the rod 16 fixed to the movable iron piece 15, and the brake shoe 12 fixed
20 to the distal end of the rod 16. The brake device 13 controls, through energization and deenergization to an electromagnet provided in the fixed iron piece 14, generation and stop of attraction force for attracting the movable iron piece 15 against the pressing force of the braking springs 21 and causes the brake shoe 12 to slide to and separate from the brake drum 11.

Figs. 5A and 5B are a front view and a side view showing the brake shoe of the
25 hoist for an elevator according to the embodiment of the present invention. Fig. 5A is a front view of the brake shoe and Fig. 5B is a side view of the brake shoe. As shown in the figures, the brake shoe 12 and the rod 16 are coupled by a leaf spring 17 functioning as an engaging member. The leaf spring 17 is provided in the brake shoe 12. The leaf spring 17 engages with an engaging piece 19 formed at the distal end portion of the rod 16. The leaf spring 17 urges,
30 with the elastic force thereof, the brake shoe 12 to the rod 16 together with a spherical dish 18 to couple the brake shoe 12 to the rod 16. With such a structure, a spherical portion formed on the side of a surface of the engaging piece 19, which is formed at the distal end of the rod 16, opposed to the brake shoe 12 comes into contact with the spherical dish 18 pressed against the spherical portion by the brake shoe 12 with the elastic force of the leaf spring 17. Since the

spherical surfaces of the spherical portion and the spherical dish 18 slide with each other, the brake shoe 12 provided at the distal end of the rod 16 can swing. This provides a function of improving contact performance between a braking surface of the brake shoe 12 and a surface to be braked of the brake drum 11.

5 Figs. 6A and 6B are top views showing states during attachment and during detachment of the brake shoe of the hoist for an elevator according to the embodiment of the present invention. Fig. 6A shows a state in which the brake shoe is attached to the rod. Fig. 6B shows a state in which the brake shoe is detached from the rod. A rectangular hole 20 is provided in the leaf spring 17. The engaging piece 19 also has a rectangular shape. During
10 assembly, the engaging piece 19 is inserted into the hole 20 in the leaf spring 17. The brake shoe 12 is rotated 90 degrees in a plane orthogonal to a direction in which the brake shoe 12 is pressed against the brake drum 11, whereby the leaf spring 17 engages with a long portion of the engaging piece 19 to couple the rod 16 and the brake shoe 12. As shown in Fig. 5A, an R portion 19a, the circumferential of which is formed round, is provided in the engaging piece 19.
15 Therefore, when the brake shoe 12 is rotated 90 degrees in the plane orthogonal to the direction in which the brake shoe 12 is pressed against the brake drum 11, in a process in which the end of the leaf spring 17 comes into contact with the engaging piece 19 and is further engaged with the engaging piece 19, the leaf spring 17 around the engaging piece 19 is prevented from being caught. It is possible to adopt a structure in which the brake shoe 12 is easily attached.

20 As explained above, the brake device 13 includes the rod 16 and the rod 16 includes the engaging piece 19 formed in the shape having a long portion and a short portion in the plane orthogonal to the direction in which the brake shoe 12 is pressed against the brake drum 11. The leaf spring 17 functioning as an engaging member that does not engage with the short portion of the engaging piece 19 and engages with the long portion of the engaging piece
25 19 is provided in the brake shoe 12. Therefore, it is possible to easily attach and detach the brake shoe 12 simply by rotating the brake shoe 12. It is possible to provide the brake device for a hoist 13 excellent in maintainability.

In this embodiment, the rectangular shape is explained as an example of the shape of the engaging piece 19 and the hole 20. However, the shape of the engaging piece 19 and the
30 hole 20 is not limited to the rectangular shape. The shape of the engaging piece 19 and the hole 20 may be any shape such as an elliptical shape or a polygonal shape as long as the engaging piece 19 has the long portion and the short portion in the plane orthogonal to the direction in which the brake shoe 12 is pressed against the brake drum 11 and the leaf spring 17 does not engage with the short portion of the engaging piece 19 and engages with the long portion of the

engaging piece 19.

Roles of the components during application of a brake and during release of the brake are explained. As shown in Fig. 4, in this embodiment, a brake device retaining member 22 attached to the main body frame 10 is provided to cover an outer portion on the opposite side to the brake drum 11 side of the brake device 13 (hereinafter simply referred to as a counter drum side, which means an upper side of the brake device 13 in Fig. 4). Position adjusting bolts 23 are screwed into the brake device retaining member 22 from the counter drum side through screw holes provided in the brake device retaining member 22. Floating springs 24 are provided between a surface of the main body frame 10 and the brake device 13. The floating springs 24 urge the brake device 13 outward in the radial direction of the brake drum 11, i.e., in Fig. 4, upward on the counter drum side. The brake device 13 attached on a lower side of the hoist is urged downward. The position adjusting bolts 23 are configured to retain the brake device 13 in a fixed position against the spring force of the floating springs 24.

As shown in Fig. 4, the main body frame 10 has surfaces opposed the brake shoe 12 in a circumferential direction in which the brake drum 11 rotates while having a gap slightly larger than the lateral width of the brake shoe 12 in a set state. These surfaces formed by the main body frame 10 form guides 25 that regulate, in a state in which the brake shoe 12 is engaged at normal time, the brake shoe 12 from rotating in the plane orthogonal to the direction in which the brake shoe 12 is pressed against the brake drum 11. In this embodiment, the guides 25 are formed by the two surfaces opposed in the circumferential direction in which the brake drum 11 rotates (the left right direction in Fig. 4). However, the guides 25 may be formed to cover three surfaces of the brake shoe 12 or cover all surfaces of the brake shoe 12 with a surface orthogonal to the axis direction of the output shaft of the motor 8.

Fig. 7 is a front enlarged view showing the braking section at normal time of the hoist for an elevator according to the embodiment of the present invention. In Fig. 7, for convenience of explanation, a release bolt 26 is shown in a state in which the release bolt 26 is attached to the rod 16. However, during normal use, the release bolt 26 is used while being detached from the rod 16. The use of the release bolt 26 is explained later.

As it is seen from Figs. 4 and 7, the brake shoe 12 is inserted between the guides 25 of the hoist 6 while having a slight gap. When the brake shoe 12 is pressed against the brake drum 11 as shown in Fig. 4, the brake shoe 12 slightly moves in the rotating direction of the brake drum 11 in slide contact with the brake drum 11 according to the rotation of the brake drum 11 and comes into contact with the guides 25. Then, the guides 25 bear a load in the rotating direction of the brake drum 11 generated by the rotating force of the brake drum 11,

which should originally be applied to the brake shoe 12 and the rod 16, which retains the brake shoe 12, in order to brake the brake drum 11. In this state, the brake device 13 continues the pressing of the brake drum 11 with the brake shoe 12 and brakes the rotation of the brake drum 11. At the same time, as explained above, the guides 25 also suppress the rotation of the brake shoe 12 in the direction around the axis of the rod 16. This makes it possible to prevent the brake shoe 12 from dropping from the engaging piece 19 and display satisfactory braking performance while realizing a simple attachment and detachment structure for the brake shoe 12. Further, as it is seen from Figs. 4 and 7, the guides 25 also form a movable path through which the brake shoe 12 can move.

In such a structure, during application of a brake, as shown in Fig. 4, the brake shoe 12 is pressed against the brake drum 11, which is a member to be braked, by the braking springs 21. Reaction of the pressing of the brake shoe 12 against the brake drum 11 is born by a compression load on the position adjusting bolts 23. During release of the brake, the movable iron piece 15 and the brake shoe 12 attracted to the fixed iron piece 14 by electromagnetic attraction force are separated from the surface of the main body frame 10 by the floating springs 24. The floating springs 24 press the fixed iron piece 14 against the position adjusting bolts 23, whereby positioning during the release can be performed. This is a mechanism for enabling adjustment of the gap during the release by setting a tightening amount of the position adjusting bolts 23. In a state in which the brake shoe 12 is engaged at normal time, the brake device 13 is fixed in a position where the brake shoe 12 is arranged in the brake shoe movable path formed by the guides 25 that regulate the brake shoe 12 from rotating in the plane orthogonal to the direction in which the brake shoe 12 is pressed against the brake drum 11.

When necessity for detaching the brake shoe 12 from the brake device 13 such as disassembling of the brake shoe 12 arises, as shown in Fig. 7, the release bolt 26 is tightened into the end opposite to the end of the rod 16 where the brake shoe 12 is attached and, in a state in which the fixed iron piece 14 and the movable iron piece 15 and the brake shoe 12 are integrated, energization to the brake device 13 is released. When the position adjusting bolts 23 are loosened in this state, as shown in Fig. 8, the integrated fixed iron piece 14, movable iron piece 15, and brake shoe 12 are drawn out further to the outside than the ends of the guides 25 by the floating springs 24. This makes it possible to move the brake device 13 to a position where the brake shoe 12 inserted into the movable path can be rotated in the plane orthogonal to the direction in which the brake shoe 12 is pressed against the brake drum 11. Further, by rotating the brake shoe 12 90 degrees as shown in Fig. 6, it is possible to remove the leaf spring 17 from the engaging piece 19 of the rod 16 and easily detach only the brake shoe 12. When the brake

shoe 12 is assembled, it is possible to use a reverse procedure to disassembly.

As explained above, in this embodiment, a brake device moving mechanism is configured by the brake device retaining member 22 provided in the main body frame 10, the floating springs 24 that urge the brake device 13 outward in the radial direction of the brake
5 drum 11, and the position adjusting bolts 23 provided in the brake device retaining member 22 that retains the brake device 13 in the fixed position against the spring force of the floating springs 24. Consequently, when it is necessary to detach the brake shoe 12, it is possible to easily move the brake shoe 12 to a position where the brake shoe 12 can be detached from the rod 16. Since the floating springs 24 are provided, irrespective of whether the brake is present
10 above or below or on the left or right of the hoist, it is possible to easily move, without being affected by the gravity, the brake device 13 to a position where the brake shoe 12 can be attached and detached.

Claims :

1. A hoist for an elevator, comprising a motor having a body frame and an output shaft, a sheave mounted in the output shaft, a brake drum arranged coaxially with the sheave to be rotatable together with the sheave, a brake shoe capable of sliding on the brake drum to brake a rotation of the sheave, and a brake device connectable to the brake shoe so that the brake shoe is pressed by the brake device against the brake drum in a pressing direction,

wherein the brake shoe is capable of being made connected to and disconnected from the brake device by rotating the brake shoe on an axis parallel to the pressing direction,

the hoist further comprises a brake shoe guide passage capable of receiving therein the brake shoe so that the brake shoe is restrained by the brake shoe guide passage from rotating on the axis, and a brake device shifting device through which the brake device and the body frame are connectable to each other so that the brake device is allowed by the brake device shifting device to be located at a first position where the brake shoe is arranged in the brake shoe guide passage when the brake device is connected to the brake shoe to be pressed against the brake drum and so that the brake device is located by the brake device shifting device at a second position where the brake shoe is arranged at the outside of the brake shoe guide passage to enable the brake shoe to be rotated on the axis when the brake shoe needs to be disconnected from the brake device.

2. The hoist according to claim 1, wherein the brake device shifting device has a brake device holding member arranged on the body frame, a floating spring for urging the brake device in a radially outward direction of the brake drum, and a positioning bolt arranged on the brake device holding member to hold the brake device at the first position against the floating spring.

3. The hoist according to claim 1 or 2, wherein the brake shoe guide passage is formed in the body frame, and is contactable with the brake shoe when the brake shoe slides on the brake drum.

4. The hoist according to any one of claims 1-3, wherein the brake device has a rod, the rod has at its front end, an engage piece including a pair of long sides and a pair of short sides as seen along the axis, and the brake shoe has an engage member capable of engaging with the pair of long sides and prevented from engaging with the pair of short sides.

5. An elevator equipment comprising a passenger cage descending and ascending in a hoistway, a main cable suspending the passenger cage, and a hoist for driving the main cable to descend and ascend the passenger cage,

wherein the hoist comprises a motor having a body frame and an output shaft, a

sheave mounted in the output shaft, a brake drum arranged coaxially with the sheave to be rotatable together with the sheave, a brake shoe capable of sliding on the brake drum to brake a rotation of the sheave, and a brake device connectable to the brake shoe so that the brake shoe is pressed by the brake device against the brake drum in a pressing direction,

wherein the brake shoe is capable of being made connected to and disconnected from the brake device by rotating the brake shoe on an axis parallel to the pressing direction,

the hoist further comprises a brake shoe guide passage capable of receiving therein the brake shoe so that the brake shoe is restrained by the brake shoe guide passage from rotating on the axis, and a brake device shifting device through which the brake device and the body frame are connectable to each other so that the brake device is allowed by the brake device shifting device to be located at a position where the brake shoe is arranged in the brake shoe guide passage when the brake device is connected to the brake shoe to be pressed against the brake drum and so that the brake device is located by the brake device shifting device at another position where the brake shoe is arranged at the outside of the brake shoe guide passage to enable the brake shoe to be rotated on the axis when the brake shoe needs to be disconnected from the brake device.
