

TITLE OF THE INVENTION

HOIST FOR ELEVATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001]

The present invention relates to a hoist for an elevator, and more particularly, to a hoist for an elevator using a main shaft with a cantilever structure.

2. Description of the Related Art

[0002]

As a hoist for an elevator using a main shaft with a cantilever structure, there is one described in JP 2013-40033 A.

[0003]

JP 2013-40033 A describes a hoist for an elevator including a housing main body storing a stator and a stator winding wire, a fixed main shaft with a cantilever structure having one end of the fixed main shaft fixed to the housing main body and the other end made a free end, a sheave rotatably attached to a free end side of the fixed main shaft via a bearing and around which a main rope is wound, a rotor integrally formed with the sheave and forming an electric motor unit in cooperation with the

stator, and a disc configured to rotate integrally with the sheave. In the hoist for an elevator, a disc brake device is disposed in an area where a position of a rotating surface of the disc does not change substantially between when the rotating surface is inclined while being subjected to a maximum load and when the rotating surface is subjected to no load or a light load. The area is located outside the main rope wound around the sheave and above a central line perpendicular to a central line of the sheave, the central line of the sheave extending in a direction of a suspended load applied on the sheave.

SUMMARY OF THE INVENTION

[0005]

However, in a case where a main shaft with a cantilever structure is used for the hoist for an elevator described in JP 2013-40033 A, the hoist is configured to increase a thickness of the housing and thus enhance the strength thereof with respect to an unbalanced load applied on the main shaft. As a result, the hoist for an elevator becomes large and heavy.

[0006]

The present invention has been made in view of the above-described point. An object of the present invention is to provide a downsized lightweight hoist for an elevator

capable of enhancing the strength of the housing, even if a main shaft with a cantilever structure is used.

[0007]

In order to accomplish the above-described object, a hoist for an elevator according to an embodiment of the present invention includes: a housing storing a stator constituting a motor; a main shaft with a cantilever structure in which one end portion of the main shaft in an axial direction is fixed to the housing and the other end portion thereof is made a free end; a sheave rotatably attached to a free end side of the main shaft via a bearing and around which a main rope coupling an elevator car with a counterweight is wound; a disc configured to integrally rotate with the sheave; a rotor integrally formed with the sheave and forming the motor in cooperation with the stator; and a pair of disc brake devices each having a brake member configured to brake the disc, the hoist for an elevator being configured to guide the main rope wound around the sheave upward or downward, wherein the pair of the disc brake devices is each supported to the housing by a supporting member thereof and the disc brake devices have a fan-shaped upper reinforcing rib and a reverse fan-shaped lower reinforcing rib, the fan-shaped upper reinforcing rib reinforces the housing in a shifting direction of the main shaft with the cantilever structure while coupling the

supporting members, and the reverse fan-shaped lower reinforcing rib reinforces the housing at a position facing the fan-shaped upper reinforcing rib in the shifting direction of the main shaft with the cantilever structure, and an area without a reinforcing rib is formed in a facing portion where the upper reinforcing rib and the lower reinforcing rib face each other.

[0008]

In the hoist for an elevator according to an embodiment of the present invention, even if a main shaft with a cantilever structure is used, the strength of the housing can be increased and the size and weight of the hoist for an elevator can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a view of a hoist for an elevator according to a first embodiment of the present invention as viewed from a housing side;

Fig. 2 is a cross-sectional view of the hoist for an elevator taken along line A-A in Fig. 1;

Fig. 3 is a view of the hoist for an elevator shown in Fig. 1 as viewed from a sheave side (arrow P direction in Fig. 2); and

Fig. 4 is a view showing the hoist for an elevator in use according to the first embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010]

A hoist for an elevator according to an embodiment of the present invention will be described below with reference to the embodiment shown in the drawings. Note that the same reference sign is used for the same component in each drawing.

[First embodiment]

[0011]

Figs. 1 to 3 show a hoist for an elevator according to the first embodiment of the present invention.

[0012]

In an elevator apparatus using the hoist for an elevator according to the present embodiment, an elevator car and a counterweight that are coupled together by a main rope are disposed in a hoistway so that the elevator car and the counterweight can move up and down. The hoist for an elevator is disposed in a gap between the hoistway and the elevator car.

[0013]

The hoist for an elevator 20 generally includes a housing 1 storing a stator 13 constituting a motor, a main shaft 3 with a cantilever structure in which one end portion of the main shaft 3 in an axial direction is fixed to the housing 1 and the other end portion thereof is made a free end, a sheave 2 rotatably attached to a free end side of the main shaft 3 via a bearing 4 and around which the main rope coupling the elevator car with the counterweight is wound, a disc 5 configured to integrally rotate with the sheave 2, a rotor 15 integrally formed with the sheave 2 and constituting the motor in cooperation with the stator 13, and a pair of disc brake devices 6A and 6B having brake members 16A and 16B configured to brake the disc 5, respectively.

[0014]

In the hoist for an elevator 20 according to the present embodiment, the pair of disc brake devices 6A and 6B is supported to the housing 1 by supporting members 7A and 7B, respectively. The disc brake devices 6A and 6B have a fan-shaped upper reinforcing rib 10 and a reverse fan-shaped lower reinforcing rib 11. The fan-shaped upper reinforcing rib 10 reinforces the housing 1 in a shifting direction of the main shaft 3 with a cantilever structure while coupling the supporting members 7A and 7B. The reverse fan-shaped lower reinforcing rib 11 reinforces the

housing 1 at a position facing the upper reinforcing rib 10 in the shifting direction of the main shaft 3 with the cantilever structure. Areas 12A and 12B each without a reinforcing rib are formed in facing portions where the upper reinforcing rib 10 and the lower reinforcing rib 11 face each other.

[0015]

The hoist for an elevator 20 according to the present embodiment will be further specifically described below. That is, the hoist for an elevator 20 according to the present embodiment includes the housing 1 and the sheave 2. The housing 1 stores the stator 13 constituting the motor. The sheave 2 is integrally constituted with a rotor core of the motor that is disposed so as to face the stator 13. The hoist for an elevator is configured to cause the sheave 2 to rotate together with the rotor core of the motor, thereby driving, and elevating and lowering the elevator car via the main rope.

[0016]

The sheave 2, around which the main rope is wound, is rotatably supported on an axial one end portion of the cantilevered main shaft 3 by the bearing 4, and the disc 5 integrally constituted with the sheave 2 is disposed in an outer periphery portion of the sheave 2. The disc 5 is rotatably disposed without touching the housing 1. The

pair of disc brake devices 6A and 6B is disposed on right and left sides in an area located in an upper part from a center axis of the sheave 2 or the main shaft 3. As shown in Fig. 1, these disc brake devices 6A and 6B are supported by the supporting members 7A and 7B coupled to a back side of the housing 1.

[0017]

Furthermore, in the housing 1, a hollow portion 9 is formed in an outer periphery of a boss portion 8 supporting the main shaft 3 at a back side of the housing 1, thereby reducing the weight of the housing 1.

[0018]

Furthermore, the fan-shaped upper reinforcing rib 10 is installed in a part of the housing 1 that is located in the lower part of the supporting members 7A and 7B and in the outer periphery portion of the hollow portion 9. The upper reinforcing rib 10 reinforces the mechanical strength of the housing 1 while coupling the lower parts of the supporting members 7A and 7B. In addition, the reverse fan-shaped lower reinforcing rib 11 is installed at a part of the housing 1 that faces the upper reinforcing rib 10 across the hollow portion 9. The areas 12A and 12B without a reinforcing rib are formed in the portions where edges of the upper reinforcing rib 10 and the lower reinforcing rib 11 face each other.

[0019]

Next, a rotating mechanism on the side of the sheave 2 will be briefly described with reference to Fig. 2.

[0020]

In Fig. 2, the axial one end of the main shaft 3 is inserted and fixed in the boss portion 8 formed in the center portion of the housing 1. The sheave 2 is rotatably supported on the free end side of the main shaft 3. With the cantilever structure of the main shaft 3, the support structure of the main shaft 3 can be simplified and the hoist for an elevator 20 can be thinned in the axial direction of the main shaft 3.

[0021]

Furthermore, a fixed portion such as the stator 13 of the motor is stored in the outer periphery portion of the housing 1. On the free end side of the main shaft 3, a bearing housing 14 is rotatably supported via the bearing 4. Rotating portions such as the sheave 2, the disc 5 and the rotor 15 of the motor described above are coupled to the bearing housing 14. The rotor 15 is disposed facing the stator 13 via a gap. Furthermore, as described in Fig. 1, the disc 5 projects more than the rotor 15 toward an outer periphery portion. The disc 5 is integrally formed with the rotor 15 and has a ring-disc geometry.

[0022]

Fig. 3 is a view of the hoist for an elevator 20 as viewed from the side of the sheave 2 (arrow P direction in Fig. 2). As shown in Fig. 2, the disc brake devices 6A and 6B include the brake members 16A and 16B, a braking force applying unit, and a braking force releasing unit, as generally known. The brake members 16A and 16B are disposed to sandwich the disc 5 in the front-back direction. While the braking force applying unit is configured to apply, to the brake members 16A and 16B, a braking force to the disc 5, the braking force releasing unit is configured to release the braking force applied by the braking force applying unit.

[0023]

Fig. 4 is a view showing the hoist for an elevator 20 in use according to the present embodiment.

[0024]

As shown in Fig. 4, the hoist for an elevator 20 is attached to a machine base 17 by fixing a supporting leg portion of the housing 1. Additionally, a pulley 18 is rotatably supported in the vicinity of the hoist for an elevator 20. A main rope 19 is wound around the sheave 2 of the hoist for an elevator 20. The main rope 19 is lowered downward using the pulley 18. The elevator car (not shown) and the counterweight (not shown), for example, are coupled to both end portions of the main rope 19. The

elevator car is configured to move up and down by rotationally driving the sheave 2 of the hoist for an elevator 20.

[0025]

Furthermore, for the hoist for an elevator 20 in use, a hoist for an elevator in which both ends of the main rope 19 wound around the sheave 2 are guided upward is similarly applicable.

[0026]

In the hoist for an elevator 20 such as the one according to the present embodiment, a cantilever structure is employed. As can be seen from the hoist for an elevator 20 shown in Fig. 2, in the cantilever structure, the axial one end portion of the main shaft 3 is supported and fixed to the housing 1 and the sheave 2 is rotatably supported to the free end of the main shaft 3.

[0027]

Therefore, a force that causes the main shaft 3 to tilt upward and downward acts on the sheave 2 through the main rope 19. As a result, the action of the force appears as a shift of the disc 5.

[0028]

Accordingly, a stable braking force is applied to the disc 5 without increasing a brake stroke in the following manner. That is, the disc brake devices 6A and 6B are

disposed in a position at which the shift of the disc 5 is minimum, that is, in a diagonal position at which an amount of shift of the disc 5 is small, as shown in Figs. 1 and 3.

[0029]

Meanwhile, an upward and downward unbalanced load acts on the main shaft 3 because of the above-mentioned cantilever structure. Therefore, it is necessary to enhance the strength of the housing 1. Simply increasing the thickness of the entire housing 1 or forming a reinforcing rib results in a larger and heavier hoist for an elevator 20.

[0030]

Accordingly, as shown in Fig. 1, the fan-shaped upper reinforcing rib 10 is formed in a part of the housing 1 that is located in the lower part of the supporting members 7A and 7B and in an outer periphery portion of the hollow portion 9. The upper reinforcing rib 10 reinforces the mechanical strength of the housing 1 while coupling the lower parts of the supporting members 7A and 7B.

[0031]

Therefore, even if the thickness of housing 1 is made smaller than that of a conventional housing, the strength of the housing 1 can be enhanced by the supporting members 7A and 7B and the upper reinforcing rib 10, and the size and weight of the hoist for an elevator 20 can be reduced.

[0032]

Moreover, a pair of the upper reinforcing rib 10 and the lower reinforcing rib 11 is disposed to face each other in portions where the upper reinforcing rib 10 and the lower reinforcing rib 11 face each other across the hollow portion 9, that is, in the shifting direction of the main shaft 3 of the housing 1. At the same time, the upper reinforcing rib 10 is formed in a fan shape and the lower reinforcing rib 11 is formed in a reverse fan shape. At this time, the areas 12A and 12B without a reinforcing rib are formed in the portions where the upper reinforcing rib 10 and the lower reinforcing rib 11 face each other.

[0033]

According to the above-described structure, an amount of the upper reinforcing rib 10 and lower reinforcing rib 11 is reduced as compared to when the housing 1 in the whole outer periphery of the hollow portion 9 is reinforced by an annular reinforcing rib. In this way, the size and weight of the hoist for an elevator 20 can be reduced while effective reinforcement is provided.

[0034]

It is to be understood that the present invention includes various modifications, but is not limited to the above-described embodiment. For example, a motor structure

including the stator 13 and the rotor 15 is not limited to the one shown in the drawings.

[0035]

In addition, the above-described embodiment has been used to describe the present invention in detail in an easy-to-understand manner. Therefore, the present invention is not limited to an embodiment that includes all the configurations described above. Furthermore, a part of a configuration of an embodiment can be replaced with a configuration of another embodiment. In addition, a configuration of an embodiment can be added to a configuration of another embodiment. Furthermore, with respect to a part of a configuration in each embodiment, additions, deletions, substitutions of other configuration can be made.

What is claimed is:

1. A hoist for an elevator, comprising:

a housing storing a stator constituting a motor;

a main shaft with a cantilever structure in which one end portion of the main shaft in an axial direction is fixed to the housing and the other end portion thereof is made a free end;

a sheave rotatably attached to a free end side of the main shaft via a bearing and around which a main rope coupling an elevator car with a counterweight is wound;

a disc configured to integrally rotate with the sheave;

a rotor integrally formed with the sheave and forming the motor in cooperation with the stator; and

a pair of disc brake devices each having a brake member configured to brake the disc, the hoist for an elevator being configured to guide the main rope wound around the sheave upward or downward,

wherein the pair of the disc brake devices is each supported to the housing by a supporting member thereof and the disc brake devices have a fan-shaped upper reinforcing rib and a reverse fan-shaped lower reinforcing rib, the fan-shaped upper reinforcing rib reinforces the housing in a shifting direction of the main shaft with the cantilever

structure while coupling the supporting members, and the reverse fan-shaped lower reinforcing rib reinforces the housing at a position facing the fan-shaped upper reinforcing rib in the shifting direction of the main shaft with the cantilever structure, and an area without a reinforcing rib is formed in a facing portion where the upper reinforcing rib and the lower reinforcing rib face each other.

2. The hoist for an elevator according to claim 1, wherein the pair of disc brake devices is disposed on the left and right in an area located above a center axis of the sheave or the main shaft, and the pair of disc brake devices is supported by the supporting members coupled to a back side of the housing.

3. The hoist for an elevator according to claim 2, wherein the pair of disc brake devices is disposed in an diagonally upward part with respect to the center axis of the sheave or the main shaft.

4. The hoist for an elevator according to claim 2, wherein the housing has a hollow portion on a back side thereof, the hollow portion being formed in an outer periphery of a boss portion supporting the main shaft.

5. The hoist for an elevator according to claim 4, wherein the upper reinforcing rib is disposed in a part of the housing that is located in a lower part of the supporting members and in the outer periphery portion of the hollow portion such that the upper reinforcing rib couples lower portions of the supporting members, and the lower reinforcing rib is disposed in a part of the housing that faces the upper reinforcing rib across the hollow portion.