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DESCRIPTION

ELEVATOR HOIST

Technical Field

[0001]

The present invention relates to an elevator hoist provided with a brake shoe, which brakes rotation
5 of a rotor of the hoist, and more particular, to an elevator hoist, which is excellent in mounting and exchanging qualities and of which a hoistway is reduced in cross sectional area.

Background Art

10 [0002]

For an elevator without a machine room, great importance is attached to quietness, space saving, and maintenance since a hoist is mounted in a hoistway. Thin-type elevator hoists comprising a braked surface
15 formed on a rotating body having a larger diameter than an external shape of a driving sheave and a brake arranged in opposition to the braked surface and pushed by the braked surface to perform a braking action for the sake of decreasing a thickness in a width direction
20 to achieve thinning and lightening are known and disclosed in, for example, Patent Document 1.

[0003]

Also, the periodic inspection of an elevator

hoist includes works such as identification of an
abraded state of a brake shoe, an abraded state of a
rope groove, a gap between a brake shoe and a braked
surface, or the like, and in the case where abrasion of
5 a brake shoe is advanced, it is necessary to exchange
the brake shoe.

[0004]

Hereupon, an arrangement, which comprises a
shoe arranged on an inner side of a cup-shaped portion
10 of a housing and provided to be able to advance toward
and retreat from a braked surface of a rotor, and a
cover provided so as to cover an opening provided in
the vicinity of the braked surface of the rotor on the
housing, and in which a sliding state of the braked
15 surface of the rotor, generation of rust, or the like
is directly and visually observed by removing the cover
at the time of maintenance, is known and described in,
for example, Patent Document 2.

[0005]

20 Further, it is known and described in, for
example, Patent Document 3 to arrange a pair of brake
arms, brake shoes, brake springs, and electromagnets,
which constitute a brake device, on a side of a sheave
and to perform maintenance and inspection works by
25 means of direct and visual observation in the same
direction.

Patent Document 1: WO 2005/019085

Patent Document 2: JP-A-2005-119860

Patent Document 3: WO 2006/011214

Disclosure of the Invention

Problems that the Invention is to Solve

[0006]

5 In that one out of arrangements described in the above-described Patent Documents, which uses a rope having strands being thinned and increased in bending flexibility by the use of a high tensile strength steel or high strength resin fibers, and in which a sheave
10 round which a rope is wound is decreased in diameter, it is not only difficult to mount a set of brake devices but also consideration is not fully given to ensure a work space in a hoistway to make a maintenance work high in efficiency, and making a hoist be close to
15 a hoistway wall as far as possible to reduce an area occupied by an elevator. In particular, with the arrangement described in Patent Document 3, a sheave faces a cage and so a motor unit protrudes toward a hoistway wall, so that it is very difficult to reduce
20 an area of a hoistway.

[0007]

 It is an object of the present invention to install a brake device in a good space efficiency to make a hoist be ultimately close to a hoistway wall to
25 reduce an area occupied by an elevator and to make it possible to have access to a brake, an encoder, etc. from a cage side to facilitate a maintenance work of a

brake device.

Means for Solving the Problems

[0008]

5 In order to solve the problems described above, the present invention provides an elevator hoist comprising a sheave, round which a rope connected to a cage of an elevator is wound, a rotor, which drives the sheave, a stator housing, on which a stator coil is
10 arranged to face permanent magnets provided annularly on the rotor, and a brake shoe, which brakes the rotor, characterized by comprising the sheave mounted to face a hoistway wall, a rotor having a recess on a side thereof toward the sheave, the brake shoe arranged in
15 the recess, a rotor hole provided on the rotor to have a larger opening than a cross section of the brake shoe, and a stator hole provided on the stator housing to have a larger opening than a cross section of the brake shoe.

20 Advantages of the Invention

[0009]

 According to the present invention, since the sheave is mounted to face a hoistway wall, a rotor hole is provided on the rotor to have a larger opening than
25 a cross section of the brake shoe, and a stator hole is also provided on the housing to have a larger opening than a cross section of the brake shoe, the brake shoe

can be exchanged from a side of the stator housing and so it is possible even in a hoist, which is small in diameter and uses a flexible rope, to make the hoist be close to the hoistway wall, thus enabling reducing an area occupied by an elevator.

Other objects, features and advantages of the present invention will become more apparent from the following description of embodiments of the invention in conjunction with the accompanying drawings.

10 Best Mode for Carrying Out the Invention

[0010]

In recent years, for a rope for driving an elevator, ropes have been put into practice by using high tensile strength steel or high strength resin fibers to thin and heighten strands of a rope in bending flexibility. With the ropes, since a sheave round which a rope is wound can be decreased in diameter, a driving torque required for a hoist is decreased and so miniaturization of the hoist can be realized. Even if a rotor can be made small in diameter, however, a support shaft provided in a hoist to suspend an elevator is required to have a diameter of predetermined dimension in terms of strength. Therefore, a space for mounting of a brake device in a rotor is rather small in a hoist of a small diameter as compared with a hoist of a large diameter.

[0011]

On the other hand, as a sheave becomes small in diameter, a driving torque for a brake suffices to be small. However, the smaller in diameter a rotor, the smaller a radius of braking, so that a push force of a brake shoe required for braking cannot be reduced and it is difficult to make an electromagnet small in size, with the result that it becomes difficult to mount a brake device on a small-diameter rotor.

Embodiment 1

10 [0012]

Fig. 2 shows a side, cross section of a machine-room-less elevator. A cage 31 of the elevator is connected to a balance weight (not shown) by a length of rope 6, and the rope 6 is hoisted by a driving sheave 5. A hoist 34 comprises the sheave 5 and a motor unit 33, and a thinned construction is generally mounted on a guide rail 32 or the like in order to reduce an cross sectional area of a hoistway. [0013]

20 Since the rope 6 rolls due to swinging of a building and traveling of the cage 31, a constant distance L to the rope 6 from the cage 31 is ensured so as to eliminate interference with the cage 31. Since the motor unit 33 is generally larger in thickness than the sheave 5, the hoist 34 is mounted so that the sheave 5 faces a hoistway wall 22. Thereby, in a state, in which the cage 31 is completely stopped, a

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worker 35 can perform maintenance work, visual confirmation of a brake, and exchange work of a brake shoe in a location disposed below the cage 31 and having a relatively wide space.

5 [0014]

Fig. 1 is a perspective view showing the whole hoist and a detailed explanation will be given.

The hoist includes a stator coil 21 arranged annularly, a housing 36 therefor, the rotor 2, on which
10 permanent magnets 9 are arranged annularly, and an encoder (not shown) for measurement of rotation of the sheave 5. The rotor 2 is curved in cross section to have a recess on a side thereof toward the sheave whereby brake shoes 11 are arranged in a space thus
15 formed.

[0015]

Since it is hard in a hoist of a small diameter to ensure a space in the rotor 2, in which space the brake shoes 11 and electromagnets 10 for
20 driving are mounted, the electromagnets 10 are arranged in a space below the sheave 5 so as to eliminate an increase in thickness of the hoist.

[0016]

Lever 12 for connection between the brake
25 shoes 11 and the electromagnets 10 are provided in a pair every the brake shoe 11, shaped to protrude toward the sheave 5 and arranged so as not to interfere with the rope 6, the rotor 2, etc.

[0017]

Two brake shoes 11 are arranged in a left-right symmetric manner so that it is easy to avoid interference with other parts and an improvement in space efficiency is achieved. On the other hand, since a space between the sheave 5 and the hoistway wall is very small, rotor holes 4 and stator holes 3, respectively, which are elongated in a circumferential direction, are provided on the rotor 2 and the stator housing 36 to enable exchanging the brake shoes 11 from a side opposite to the sheave, that is, from a cage side.

[0018]

While the brake shoes 11 can be likewise arranged by curving the rotor 2 in cross section so as to provide a recess on the side thereof opposite to the sheave, the levers 12 for connection protrude in a width direction of the hoist, so that it is difficult to thin the hoist as a whole.

20 [0019]

While the brake shoes 11 are pushed against an outer peripheral surface (a) of the rotor, which is made integral with the sheave 5, from outside, an inner peripheral surface (b) of the rotor, which is curved, may be pushed by the brake shoes from inside. Push springs 13 are mounted to the levers 12, and when the cage is stopped, power distribution to the electromagnets 10 is stopped and a frictional force by

means of spring forces brakes rotation of the rotor 2. When the cage is to be operated, power distribution to the electromagnets 10 is performed to accomplish an operation for separation from the braked surface (a).

5 [0020]

Since a large force is required for a braking operation, it is desired that a rotation fulcrum 18 of the lever 12 be made as close to the brake shoe 11 as possible and kept away from the electromagnet 10. That is, a lever ratio is enlarged and attraction required for the electromagnet 10 is decreased. Also, a stroke demanded for the electromagnet 10 is made long, but noises at the time of attraction and release can be reduced by using a proportional solenoid of which
10
15 attracting force becomes constant in response to a gap.
[0021]

Fig. 3 is a top view showing the embodiment (depiction of the levers and the electromagnets are omitted), Fig. 4 is a front view as viewed from the
20 sheave side (depiction of the levers and the electromagnets are omitted), and a detailed explanation will be described.

[0022]

While the rotor 2 and the sheave 5 are
25 mechanically joined together, they may be made integral with each other. The rotor 2 has a bearing 27 press-fitted thereinto to rotate on a support shaft 7 made integral with, or mechanically connected to the housing

36. In order to brake the rotor 2, an outer peripheral surface thereof being equal to or smaller in diameter than the sheave 5 is made a braked portion and the brake shoes 11 are pushed against the rotating braked surface (a) from outside. At this time, the inner peripheral surface (b) of the rotor, which is curved, may be braked, in which case an outer peripheral wall thickness (t) must be made large so as to withstand a large braking force given by the brake shoes 11. In contrast thereto, when the outer peripheral surface (a) of the rotor 2 should be braked, a wall thickness (s) can be increased in a radial direction without an increase in diameter of the whole hoist, so that such arrangement is suited to reduction in diameter of the hoist.

[0023]

In order to attain space saving for a cross section of the hoistway, the hoist is mounted with the sheave 5 facing the hoistway wall 22. Since it is difficult to exchange the brake shoes 11 from the hoistway wall 22 side, the rotor holes 4 and the stator holes 3, which comprise openings, are provided on the rotor 2 and the housing 36, respectively. Thereby, it is possible to exchange the brake shoes 11 from the cage side in a position, in which the both holes overlap together as shown in Fig. 4.

[0024]

Since the rotor holes 4 are provided on the

rotor 2, rubbish and dust are liable to be come into a side of an electromagnetic device including the stator coils 21. Therefore, a clearance (e) between the rotor 2 and the housing 36 in the width direction of the hoist is made smaller than a width (p) of the holes of the rotor 2 in a radial direction, or a width (q) of the holes on the stator side. Also, a disk-shaped cover 17 is provided on the side of the housing 36 toward the sheave, and a projection 19 and a ring-shaped cover 25 are provided on an outer periphery of the rotor 2.

[0025]

The encoder 8 for detecting rotation of the sheave 5 is joined integrally to the sheave 5 and mounted in a recess of the housing 36, which is provided on a side opposite to the sheave 5, through an encoder shaft 24. Thereby, it is possible to access to the encoder 8 from the cage side, thus enabling readily performing exchange work.

20 [0026]

As shown in Fig. 4, the rotor 2 is provided with the rotor holes 4a, 4c, which are larger than the cross section of the rotor. Also, in the circumferential direction, small rotor holes 4b, 4d are further formed, and an inner periphery and an outer periphery of the rotor 2 are connected together by spokes 20. Preferably, ribs (not shown) are provided on the spokes 20 so as to ensure a sufficient stiffness

therefor.

[0027]

Likewise, stator holes 3a, 3b being larger in cross section than the brake shoes are formed on the stator housing 36 to be disposed in the vicinity of the
5 brake shoes 11. Rotation of the rotor causes the both holes formed on the stator housing 36 and the rotor 2 to overlap together in the circumferential direction, in which position it is possible to exchange two left
10 and right brake shoes 11 at the same time.

[0028]

A length (m) of the large rotor holes 4a, 4c of the rotor 2 in the circumferential direction must be larger than a length (k) of the brake shoes 11. The
15 larger area of the rotor holes 4 of the rotor, the easier it is to visually observe the brake shoes 11 from a side opposite to the sheave, so that it is possible to efficiently perform an exchange work. On the other hand, a circumferential length (n) of the
20 rotor holes 4b, 4d being intermediate between the holes 4a, 4c may be smaller than the length (k) of the brake shoes. The holes 4b, 4d serve to allow confirmation of a clearance between the brake shoes 11 and the braked surface rather than exchange.

25 [0029]

The rotor 2 is structured such that the rotor hole 4 is at least one in number and the housing 36 is structured such that the stator hole 4 is the same

number as that of the brake shoes 11. While the stator holes 3a, 3b on the housing 36 side are surely required on back surfaces of the brake shoes 11, the rotor holes 4 on the rotor side may be plural in number at irregular pitches instead of being left-right symmetric, as far as the brake shoes 11 are shaped to enable removal. The rotor holes 4 on the rotor 2 are not limited to four in number but suffice to be at least one in number provided that a larger hole than the brake shoes 11 is present. Provided that a circumferential length (f) of that portion, on which the hole is not formed, is shorter than the brake shoes 11, it is possible to surely confirm the brake shoes 11.

15 [0030]

Fig. 5 is a rear view showing the hoist as viewed from a side opposite to the sheave (depiction of the levers and the electromagnets is omitted). Maintenance personnel will see the hoist from the cage side in a state shown in the figure.

[0031]

In the case where the rotor 2 stops in a position shown in Fig. 5, the rotor holes 4a, 4c of the rotor 2 do not overlap the stator holes 3a, 3b of the stator housing 36 and the spoke 20 of the rotor 2 gets in the way to make it impossible to exchange a brake shoe 11a. At this time, the rotor 2 is rotated to bring about a state, in which the both holes overlap

each other. Then fixation bolts 37 mounted to a back surface of the brake shoe 11a are loosened and the brake shoe 11a is taken out on this side in the figure. In addition, projections or holes (not shown) are
5 provided on the brake shoe 11 so as to facilitate taking-out. The positional relationship shown in Fig. 5 makes it impossible to exchange the brake shoe 11a but it is possible to confirm the brake shoes 11, the braked surface, and a clearance through the small rotor
10 holes 4b, 4d of the rotor 2.

Embodiment 2

[0032]

Fig. 6 shows Embodiment 2 and is a rear view showing the hoist in the same manner as in Fig. 5.

15 As shown in the figure, four brake shoes 11 are provided so as to ensure a sufficient braking area in the circumferential direction. Stator holes 3 of a stator housing 36 are four in number to be the same as that of the brake shoes 11. The stator holes 3 are
20 arranged at an equal pitch of 90 degrees, so that it is possible to exchange the brake shoes 11 in rotating positions every 90 degrees. In addition, since a circumferential length of ribs 20 is shorter than a circumferential length of the holes 3 of the stator
25 housing, it is possible to confirm the brake shoes 11, a braked surface, and a clearance in the same manner as in Fig. 5.

[0033]

In order to automatically stop the cage in a position, in which the respective holes of the housing 36 and the rotor 2 overlap each other when maintenance work is to be performed, a mode of maintenance operation using the encoder 8 is provided for. That is, when a hoist is to be mounted, pulse count of the encoder 8 is stored in a recording medium in a position, in which removal of the brake shoes 11 is easy, and at the time of maintenance, the cage is moved up and down to take count of encoder pulses at all times. In a position, in which a difference between pulse thus counted and pulse thus stored becomes zero, rotation of the rotor 2 is stopped to stop the cage.

15 [0034]

In addition, the pulse thus stored is not limited to one in number but may be plural in number. For example, when 180 degrees of rotation of the rotor holes 4 are necessary and rotation of the encoder 8 per one pulse is 0.5 degrees, a value obtained by adding 360 pulses to the stored pulse is stored as a reference value. In a position, in which a difference between the measured pulse and one of the reference values is 0, the cage should be stopped. In addition, even if a difference between the count pulse and the stored pulse is not 0, stoppage of the cage can be made at a value having some range in response to a size of the rotor holes 4 of the rotor 2. Also, means for detecting the

position, in which the both holes overlap each other, may be provided using a sensor for detecting mutual positions between a guide rail (not shown) mounted on a building side and the cage.

5 [0035]

As described above, it is possible to stop the cage in the position, in which the brake shoes can be surely removed.

Embodiment 3

10 [0036]

Subsequently, Embodiment 3 will be described in detail with reference to Fig. 7.

Desirably, a lower end of the hoist is positioned to be higher than a level 23 of an entrance and exit in order to prevent natural disasters, in particular, flooding due to floodwater or the like. The larger a carrying capacity of a cage, the larger a driving torque required for a hoist of an elevator. With a large-sized type of hoist, a carrying capacity of which exceeds, for example, 1000 kg, a stator housing 36 is increased in diameter, so that it is not possible to mount two electromagnets on a lower portion of a hoist. Accordingly, in the case where an equipment machinery such as a balance weight or the like is arranged to allow a space to be present in a width direction of a hoist, electromagnets 14 can also be arranged left and right in a horizontal direction

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20
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instead of being arranged below the stator housing 36. At this time, a lever 12 for operation of a brake shoe 11 is preferably, for example, L-shaped to have a rotation fulcrum 18 at a right bent portion thereof.

5 [0037]

With the construction, it is possible to freely change a lever ratio without increasing a hoist in height dimension. Also, according to a further embodiment, it is possible to mount only one
10 electromagnet on a lower portion of a hoist and to mount another electromagnet in a position above a sheave and being distant less of a width, over which a length of rope is wound.

[0038]

15 Further, two pairs of brake shoes 11 and electromagnets 14 are not limitative but brake shoes 11 and electromagnets 14 may be arranged in left, right and lower three locations, or in left, right, upper and lower four locations in the case where a large braking
20 torque is needed. With such construction, it is possible to reduce a capacity per one electromagnet 14.

[0039]

While the embodiments have been described, it is apparent to those skilled in the art that the
25 invention is not limited thereto but various changes and modifications may be made within the spirit of the invention and the scope defined by the appended claims.

Brief Description of the Drawings

[0040]

[Fig. 1] Fig. 1 is a perspective view showing an elevator hoist according to an embodiment of
5 the invention.

[Fig. 2] Fig. 2 is a side, cross sectional view showing an elevator according to the embodiment.

[Fig. 3] Fig. 3 is a cross sectional view showing the elevator hoist according to the embodiment,
10 as viewed from above.

[Fig. 4] Fig. 4 is a front view showing the elevator hoist according to the embodiment.

[Fig. 5] Fig. 5 is a rear view showing the elevator hoist according to the embodiment.

15 [Fig. 6] Fig. 6 is a rear view showing an elevator hoist according to a further embodiment.

[Fig. 7] Fig. 7 is a front view showing an elevator hoist according to a still further embodiment.

Description of Reference Numerals and Signs

20 [0041]

2: rotor

3a, 3b, 3c: stator hole

4a, 4b, 4c: rotor hole

5: sheave

6: rope

7: support shaft

8: encoder

9: permanent magnet
10a, 10b: electromagnet
11a, 11b: brake shoe
12a, 12b: lever
13a, 13b: push spring
21: stator coil
22: hoistway wall
24: encoder shaft
25: cover
31: cage

CLAIMS

1. An elevator hoist comprising: a sheave, round which a rope connected to a cage of an elevator is wound; a rotor, which drives the sheave; a stator housing, on which a stator coil is arranged to face permanent magnets provided annularly on the rotor; and brake shoes, which brake the rotor,

characterized by comprising:

the sheave mounted to face a hoistway wall;

a rotor having a recess on a side thereof toward the sheave;

the brake shoes arranged in the recess;

rotor holes provided on the rotor to have a larger opening than a cross section of the brake shoes; and

stator holes provided on the stator housing to have a larger opening than a cross section of the brake shoes.

2. The elevator hoist according to claim 1, characterized by further comprising: electromagnets arranged below the sheave; and levers connected between the brake shoes and the electromagnets.

3. The elevator hoist according to claim 1, characterized in that two of the brake shoes are arranged in symmetry positions and are exchangeable from a side toward the cage.

4. The elevator hoist according to claim 1, characterized in that the rotor and the sheave are

connected or integrally formed with each other, and a braked portion for braking of the rotor is defined by an outer peripheral surface of the sheave, which is equal to or smaller than a diameter thereof, and pushed by the brake shoes from outside the outer peripheral surface.

5. The elevator hoist according to claim 1, characterized by further comprising: an encoder shaft integrally joined with the sheave; a recess provided on an opposite side of the housing to the sheave; and an encoder mounted in the recess of the housing to detect rotation of the sheave through the encoder shaft.

6. The elevator hoist according to claim 1, characterized in that a second rotor hole is provided to be smaller than said rotor holes.