

ELEVATOR TRACTION MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to an elevator traction machine for use in an elevator apparatus.

Generally, in an elevator traction machine, a braking unit is used in which a brake
5 pad is pushed against an outer peripheral portion of a cylindrical member to be braked while the
cylindrical member rotating in synchronism with the rotation of a driving sheave. For the brake
pad of braking unit, a soft-type friction material of glass fibers has hitherto been used.

WO2004/050527 discloses the construction of a brake structure for traction
machine according to which a plurality of braking members are so arranged as to oppose the
10 inner wall of a brake drum and each of the plural braking members is provided with an elastic
member through which the braking member pushes against the inner wall. In the
WO2004/050527, by arranging the plural braking members in opposition to the braking surface
of a brake and by providing each braking member with the elastic member adapted for applying
braking force, each braking member can take charge of a braking force smaller than conventional
15 one and sizes of the elastic member and an electromagnet can be reduced. In addition, a
collision sound the braking member makes when colliding against the braking surface can be
reduced.

SUMMARY OF THE INVENTION

In recent years, however, an elevator traction machine which uses, as the brake
20 pad, a hard-type friction material having excellent characteristics under high surface pressures
for the sake of achieving size reduction and high performance has been becoming a main type of
machine. With such a hard-type friction material used, it has been proven that when the brake
unit remains having the same construction as that of the conventional one, the ratio of contact
with a member to be braked decreases and frictional characteristics become unstable.
25 Consequently, depending on the contact condition, a bending stress is caused in the brake pad
central portion extending in the rotational direction of the braked member, giving rise to such a
condition that the brake pad will be cracked or fractured.

Accordingly, an object of the present invention is to provide a novel elevator
traction machine which can prevent, by using a simplified construction, the brake pad from being
30 cracked or fractured.

According to the present invention, in an elevator traction machine having a main rope for ascending and descending an elevator car and a counterweight, a driving sheave around which the main rope is wound, a member to be braked which rotates integrally with the driving sheave and an electromagnetic brake device which pushes a brake pad against a braking surface of the member to be braked so as to brake the driving sheave and the member to be braked, the electromagnetic brake device includes a holding shoe which is attached, through the medium of a shock absorber, with brake pads which are two divisions extending in the rotational direction of the member to be braked so as to push each of the brake pads against the braking surface.

Also, in the elevator traction machine, the brake pad is formed from a hard-type friction material.

Further, in the elevator traction machine, each of the brake pads is fixed to the holding shoe by means of fixers at a plurality of fixing positions which are different in number in the rotational direction of the member to be braked, so that forces of fixing to the holding shoe by the fixers may be different at the plural fixing positions to thereby make the fixing force weaker at a fixing position on a boundary side of the brake pads adjoining to each other than at a fixing position opposite to the boundary side.

In the elevator traction machine, a screw is used as the fixer.

In the elevator traction machine, each brake pad has the same shape.

In the elevator traction machine, a plurality of positions for fixing the individual brake pads are arranged symmetrically to a center line of the holding shoe.

In the elevator traction machine, an amount of displacement to a holding shoe on a boundary side of the respective brake pads adjacent to each other is made larger than on an opposite side remote from the boundary side.

According to the present invention, in an elevator traction machine provided with the electromagnetic brake device, the electromagnetic brake device includes a holding shoe which is mounted, through the medium of a shock absorber, with brake pads which are two divisions extending in the rotational direction of a member to be braked so as to push each of the brake pads against the braking surface of the member to be braked, thereby ensuring that when the brake pad comes into contact with the braking surface of member to be braked, the capability to follow-up the braking surface can be improved so as to prevent bending stress from occurring in contrast to the prior art and that crack or fracture can be prevented from occurring particularly at the central portion of the brake pad and the braking performance can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram illustrating a schematic construction of an elevator apparatus according to an embodiment of the present invention.

Fig. 2 is a diagram showing a front view of an electromagnetic brake device in an elevator traction machine of the present invention.

5 Fig. 3 is an enlarged longitudinally sectional diagram of the electromagnetic brake device in the elevator traction machine of the present invention.

Fig. 4 is a fragmentary enlarged longitudinally sectional diagram of an essential part of the electromagnetic brake device of the invention shown in Fig. 3.

10 Fig. 5 is a bottom view diagram of the electromagnetic brake device of the invention shown in Fig. 4.

Fig. 6 is a bottom view diagram of an example to which the electromagnetic brake device of the invention shown in Fig. 5 is applied.

DESCRIPTION OF THE EMBODIMENTS

15 Embodiments of the present invention will now be described with reference to the accompanying drawings.

Referring first to Fig. 1, an elevator apparatus comprises an elevator car 2 and a counterweight 3 which are ascendable and descendible within a hoistway 1 and an elevator traction machine 4 having a driving sheave 5 around which a main rope 6 adapted to suspend the elevator car and counterweight is wound. By rotating the driving sheave 5 by means of the
20 elevator traction machine 4 to wind up the main rope 6 wound around the driving sheave 5, the elevator car 2 and counterweight 3 can be driven up and down within the hoistway 1. In Fig. 1, the elevator traction machine 4 is exemplified as a machine of thin type which is installed along one wall surface inside the hoistway 1 in substantially parallel therewith so as to lie between the inner wall surface of hoistway 1 and the elevator car 2.

25 A front of elevator traction machine 4 as viewed from the hoistway wall side is illustrated in Fig. 2. The main rope 6 for suspending the elevator car 2 and counterweight 3 is wound around the driving sheave 5 located on the front side of elevator traction machine 4, and a cabinet frame 8 is arranged behind the driving sheave 5.

30 The elevator traction machine 4 can be constructed in various ways. For example, a brake drum 7 is provided as a braking member which rotates along with the driving sheave 5 coaxially therewith and a motor rotor is attached to the brake drum 7 while a motor stator being attached to the cabinet frame 8 so as to constitute an outer rotor type motor between the brake drum 7 and the cabinet frame 8, and by supplying electric current to the outer rotor

type motor, the driving sheave 5 and brake drum 7 are driven to rotate.

Electromagnetic brake devices 9 of the same construction are arranged above and below the cabinet frame 8, respectively, and by pushing a pair of brake pads 11a and 11b against the brake drum 7, rotation of the driving sheave 5 and brake drum 7 can be braked. In the example, a window 10 is formed at a portion of cabinet frame 8 confronting the brake pads 11a and 11b to thereby enable an operator to inspect consuming states of brake pads 11a and 11b.

Of the electromagnetic brake devices 9, an essential part of the upwardly arranged one is illustrated in longitudinally sectional form in Fig. 3. A hole 13 is opened in an upward outer wall portion 12 of cabinet frame 8 and the electromagnetic brake device 9 is mounted at a position corresponding to the hole 13 so that the brake pads 11a and 11b may pass through the hole so as to contact with a braking surface 14 of brake drum 7.

The electromagnetic brake device 9 includes a base 16 detachably attached to the cabinet frame 8 by means of fixers 15, a movable rod 17 mounted slidably to the base 16 so as to move toward the brake drum 7, a movable iron core 18 arranged integrally with the movable rod 17, a holding shoe 19 detachably connected to one end of movable rod 17 on the side of brake drum 7, and the brake pads 11a and 11b which are mounted integrally to the holding shoe 19 and pressed against the braking surface 14 so as to brake the rotation of the brake drum 7 and which are constituted by a plurality of divisions extending in the rotational direction of brake drum 7 as indicated at arrow.

The electromagnetic brake device 9 further includes a brake spring 20 which is constantly biased to push the brake pads 11a and 11b against the braking surface 14 of brake drum 7, thus generating braking force, and an electromagnetic coil 21 which is so arranged as to surround the movable rod 17 and which when excited, drives the brake pads 11a and 11b and movable rod 17 in opposition to the brake spring 20 in a brake release direction.

The brake spring 20 pushes the movable core 18 toward the brake drum 7 and consequently, pushes the brake pads 11a and 11b against the braking surface 14 of brake drum 7 to thereby perform braking through the medium of movable rod 17 integral with the movable core 18. In contrast, the electromagnetic coil 21 is excited by current conduction and drives the brake pads 11a and 11b in opposition to the spring force of brake spring 20 in a direction of leaving them from the brake drum 7 to thereby release the braking force.

Accordingly, when current conduction to the electromagnetic coil 21 of electromagnet is interrupted, excitation of the electromagnetic coil 21 is released, with the result that the spring force of brake spring 20 causes the brake pads 11a and 11b to be pushed against the braking surface 14 of brake drum 7 to thereby apply braking force to the driving sheave 5.

As shown in Fig. 4, the holding shoe 19 is provided with a shock absorber 22 made of a rubber sheet, for instance, and the brake pads 11a and 11b constituted by plural divisional members extending in the rotational direction of brake drum 7 are juxtaposed slightly distantly on the shock absorber 22 and fixed by means of plural fixers, respectively. Used for the brake pads 11a and 11b is a hard-type friction material formed by mixing and shaping resins having excellent characteristics under high surface pressure.

Bottoms of the brake pads 11a and 11b as viewed from brake drum 7 are illustrated in Fig. 5, with indication of the rotational direction of brake drum 7 in right and left directions. The brake pads 11a and 11b are mounted bilaterally symmetrically to a center line C of holding shoe 19. Positions for clamping screw members are also bilaterally symmetrical to the center line C and clamping forces for respective screws are constant.

In the illustration, the brake pad 11a is fixed to the holding shoe 19 at two clamping locations which are different in the rotational direction of brake drum 7 with the help of screws as shown in Fig. 5. At a central spot of brake pad 11a close to the center line C of holding shoe 19 in a boundary side of the brake pads adjoining to each other, a screw 23 is used and is clamped at a fixing position displacing from the boundary side to the brake pad center.

Further, at a fixing position on the side of each brake pad remote from the center line C, that is, on the outer side of brake pad 11a, two screws 24 and 25 distantly arranged in the width direction are used so as to be clamped at fixing positions displaced toward the edge side of brake pad 11a. As a result, fixing force for the brake pad 11a near the screw 23 close to the center line C of holding shoe 19 is weaker than that at fixing positions near the screws 24 and 25.

For the brake pad 11b, a screw 26 is used likewise at a central portion of brake pad 11b close to the center line C and the screw 26 is clamped at a fixing position displaced from the boundary side to the brake pad center. At fixing positions on the outer side of brake pad 11b remote from the center line C, two screws 27 and 28 arranged in the width direction are used to clamp the brake pad 11b at fixing positions displaced toward the edge side.

As a result, fixing force for the brake pad 11b near the screw 26 close to the center line C of holding shoe 19 is weaker than that at the fixing positions near the screws 27 and 28.

Namely, in a set of two brake pads 11a and 11b, the fixing force is set as being weaker at the central portion near the center line C of holding shoe 19 than at the both edge portions.

When attaching the divisional brake pads 11a and 11b to the holding shoe 19, the shock absorber 22 is first arranged on the holding shoe 19 and subsequently, the screws 24 and

25 and the screws 27 and 28 are clamped while pushing the remote sides of the two brake pads 11a and 11b against the holding shoe 19, respectively. Thereafter, by clamping the screws 23 and 26 on the boundary sides of the brake pads adjoining to each other, fixing force can be made to be stronger with ease at fixing positions of both the brake pads 11a and 11b which are remote
5 from center line C of holding shoe 19 than that at fixing positions of both the brake pads 11a and 11b close to the center line C.

By executing fixing in this manner, the individual brake pads 11a and 11b are fixed to the holding shoe 19 by way of the shock absorber 22, so that in respect of the center on a line connecting the screws 24 and 25 or on a line connecting the screws 27 and 28, displacement
10 becomes possible in a direction orthogonal to the braking surface 14 of brake drum 7 so as to promote following-up the braking surface 14. Further, since the individual brake pads 11a and 11b can deform so as to envelope the braking surface 14 of brake drum 7, the braking performance can be improved.

When, with the use of the electromagnetic brake device 9 of the structure as
15 above, conduction of electric current to the electromagnetic coil 21 is interrupted and the brake pads 11a and 11b are pressed against the braking surface 14 of brake drum 7 with the help of spring force of the brake spring 20, the brake pads 11a and 11b can contact with the braking surface 14 of brake drum 7 while improving following-up the braking surface 14 owing to the division of the brake pads 11a and 11b in the rotational direction of brake drum 7, with the result
20 that any stress as in the prior art is not generated and the split generation and fracture at the central portion of each of the brake pads 11a and 11b can be prevented with the simplified structure. In addition, the capability to brake the brake pad can be improved.

Illustrated in Fig. 6 is an example of applicable use of positions of screws for fixing the individual brake pads 11a and 11b to the holding shoe 19. Even when a single screw
25 is used at each of the fixing positions remote from the center line C of holding shoe 19 as indicated by screw 29 or 30, the relation between screw positions defines that the edge of each of the brake pads 11a and 11b close to the center line C is free end and therefore, displacement in the direction orthogonal to the braking surface 14 of brake drum 7 becomes easy, thus promoting the capability to follow-up the braking surface 14.

30 It should be understood that structurally, the elevator traction machine of the present invention is not limited to the construction shown in Figs. 2 and 3 but can be applicable to a different construction.

CLAIMS:

1. An elevator traction machine (4) comprising:
 a driving sheave (5) about which a main rope (6) adapted to ascend and descend
an elevator car (2) and a counter weight (3) is wound;
 a member to be braked (7) which rotates integrally with said driving sheave (5);
and
 an electromagnetic brake device (9) having brake pads (11a, 11b) and operating to
push said brake pads against a braking surface (14) of said member to be braked (7) so as to
brake said driving sheave and said member to be braked,
 wherein two divisional brake pads (11a, 11b) which are two divisions extending
in the rotational direction of said member to be braked are attached respectively to a holding
shoe (19) provided for said electromagnetic brake device through the medium of a shock
absorber (22), and the individual brake pads are respectively pressed against said braking
surface.
2. An elevator traction machine according to claim 1, wherein said brake pad (11a,
11b) is made of a hard-type friction material.
3. An elevator traction machine according to claim 1 or 2, wherein each of said
brake pads (11a, 11b) is fixed to said holding shoe (19) by means of fixing members (23 to 25,
26 to 28) at a plurality of different fixing positions in the rotational direction of said member to
be braked, forces said fixing members apply to said holding shoe at said plural fixing positions
are made different from one another in such a manner that a fixing force at a fixing position close
to a boundary side of said brake pads adjoining to each other is made weaker than that at a fixing
position remote from the boundary side.
4. An elevator traction machine according to claim 3, wherein a screw (23 to 28) is
used as said fixing member.
5. An elevator traction machine according to any one of claims 1 to 4, wherein each
of said brake pads has the same shape.
6. An elevator traction machine according to claim 5, wherein a plurality of
positions for fixing said individual brake pads are arranged symmetrically to the center line of
said holding shoe.
7. An elevator traction machine according to any one of claims 1 to 6, wherein an
amount of displacement to a holding shoe on a boundary side of the respective brake pads
adjacent to each other is made larger than on an opposite side remote from the boundary side.