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(71) Applicant:
MITSUBISHI DENKI KABUSHIKI KAISHA
Tokyo 100-8310 (JP)

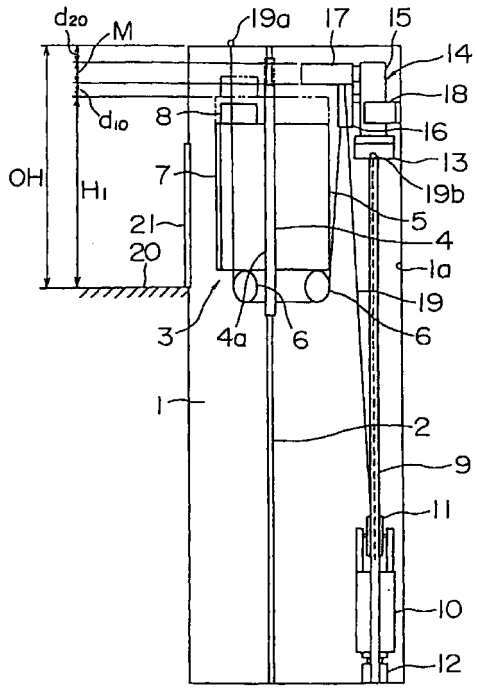
(72) Inventors:
- **Okada, Koji**
  Chiyoda-ku, Tokyo 100-8310 (JP)
- **Ishii, Toshiaki**
  Chiyoda-ku, Tokyo 100-8310 (JP)
- **Maruyama, Naoyuki**
  Chiyoda-ku, Tokyo 100-8310 (JP)

(74) Representative: **HOFFMANN - EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) Elevator

(57) In an elevator, when a car and a hoisting machine are vertically projected on a horizontal plane, a reduction gear device and a traction sheave are located outside an area on which the car is projected. A part of a motor is located inside an area on which the car is projected. The surface of the motor facing the car is located above a lower end portion of at least the reduction gear device or the traction sheave.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an elevator having a hoisting machine disposed in an upper part of a hoistway and not in a machine room.

2. Description of the Related Art

[0002] In recent years, so called "machine-room-less elevators" in which devices such as hoisting machines or control panels and the like are disposed in a hoistway without providing a machine room in the upper part of the hoistway have been proposed. For example, Fig. 5 is a side view showing a conventional machine-room-less elevator, as disclosed in Japanese Patent Application Laid-open No. Hei 10-81463. In this conventional elevator, a hoisting machine 43 is supported on counterweight guide rails 42 provided in a hoistway 41. A car 44 is guided by car guide rails 45 to be elevated and lowered in the hoistway 41.

[0003] In the conventional machine-room-less elevator as described above, when the hoisting machine 43 and the car 44 are vertically projected on a horizontal plane, either the area of the hoistway 41 is increased or the floor area of the car 44 is decreased relative to the area of the restricted hoistway because the hoisting machine 43 and the car 44 are arranged so that they do not overlap each other.

[0004] Further, Japanese Patent Application Laid-open No. Hei 6-345367 for instance, discloses a simple elevator for two storey applications in which a hoisting machine is supported by a car guide rail just above a car. In the elevator mentioned above, however, when the hoisting machine and the car are vertically projected on a horizontal plane, the hoisting machine is arranged so as to completely overlap the car. Therefore, the height from the level of an uppermost floor to the ceiling of the hoistway, that is, the overhead dimension, is increased just by the amount for the machine room.

[0005] Still further, in an elevator having a counterweight, when the counterweight is lowered to a lowermost travelling position to completely compress a weight buffer, the car jumps up, so that it is necessary to ensure a space further above the normal uppermost travelling position of the car. In other words, if the hoisting machine is provided just above the car, sufficient space needs to be secured so that devices located on top of the car do not collide with the hoisting machine even if the car jumps upward. Therefore, the overhead dimension must be increased accordingly.

SUMMARY OF THE INVENTION

[0006] The present invention has been made to overcome the above-described problems, and it is an object of the present invention to proved an elevator in which the floor area of a car can be increased relative to the area of a restricted hoistway, and overhead dimensions can be reduced.

To this end, according to one aspect of the present invention, there is provided an elevator comprising: a hoistway; a car and a counterweight alternately elevated and lowered in the hoistway; a rope for suspending the car and the counterweight in the hoistway; and a hoisting machine, provided in an upper part of the hoistway, including a traction sheave on which the rope is wound, a motor for rotating the traction sheave, and a reduction gear device connected between the traction sheave and the motor, for elevating and lowering the car and the counterweight through the rope; wherein when the car and the hoisting machine are vertically projected on a horizontal plane, the reduction gear device and the traction sheave are located outside an area on which the car is projected, and a part of the motor is located inside an area on which the car is projected, respectively, and a surface of the motor facing the car is located above a lower end of at least one of the reduction gear device and the traction sheave.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Other characteristics will be apparent on reading the description that follows with reference to the attached drawings in which:

Fig. 1 is a side view of an elevator according to a first embodiment of the present invention;
Fig. 2 is a plan view of the elevator shown in Fig. 1;
Fig. 3 is a side view of an elevator according to a second embodiment of the present invention;
Fig. 4 is a plan view of the elevator shown in Fig. 3; and
Fig. 5 is a side view showing one example of a conventional elevator.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0008] Now, referring to the accompanying drawings, embodiments of the present invention will be described hereinafter.

Embodiment 1

[0009] Fig. 1 is a side view of an elevator according to a first embodiment of the present invention. Fig. 2 is a plan view of the elevator shown in Fig. 1. Fig. 1 illustrates a state in which a counterweight is lowered to its lowermost travelling position.

[0010] In these figures, a pair of car guide rails 2 are disposed in a hoistway 1. A car 3 is guided by the car guide rails 2 to be elevated and lowered in the hoistway 1. The car 3 is provided with a car frame 4, a car cabin 5 supported by the car frame 4, a pair of car pulleys 6 rotatably provided at the lower part of the car cabin 5, a car door 7 for opening and closing the entrance of the car cabin 5 and a switching device 8 provided in the upper part of the car cabin 5 to drive the car door 7. Further, the car frame 4 includes a pair of vertical posts 4a and a top beam 4b fixed between the vertical posts 4a above the car cabin 5.

[0011] In the hoistway 1, a pair of weight guide rails are provided. A counterweight 10 is elevated and lowered along the weight guide rails 9. A rotatable weight pulley 11 is provided at the upper part of the counterweight 10. A weight buffer 12, for bearing the counterweight 10, is provided at the bottom part of the hoistway 1. Fig. 1 shows a state in which the buffer is pushed down by bearing the counterweight 10. A car buffer for bearing the car 3 is not illustrated in the drawings.

[0012] A hoisting machine mount 13 is fixed between an upper portion of the pair of weight guide rails 9. A hoisting machine 14 for elevating and lowering the car 3 and the counterweight 10 is mounted on the hoisting machine mount 13 in the upper part of the hoistway 1. The hoisting machine 14 is equipped with a reduction gear device 15 mounted on the hoisting machine mount 13, a traction sheave 16 connected to the output shaft of the reduction gear device 15 and a motor 17 connected to the input shaft of the reduction gear device 15 to drive the traction sheave 16 through the reduction gear device 15.

[0013] Further, as shown in Fig. 2, when the car 3 and the hoisting machine 14 are vertically projected on a horizontal plane, the reduction gear device 15 and the traction sheave 16 are located outside the area on which the car 3 is projected, that is to say, at positions where the reduction gear device 15 and the traction sheave 16 do not overlap the car 3, and the motor 17 is located so that a part of it is arranged inside the area on which the car 3 is projected, namely at a position where the motor 17 overlaps the car 3, respectively. Still further, as shown in Fig. 1, the surface of the motor 17 facing the roof of the car cabin 5 is located above the lower ends of the reduction gear device 15 and the traction sheave 16. Reference numeral 18 denotes a pair of fixing arms for fixing the reduction gear device 15 onto the side wall 1a of the hoistway 1.

[0014] The car 3 and the counterweight 10 are suspended in the hoistway 1 through a rope 19. The rope 19 has respectively a car side end 19a fastened to the upper part of the hoistway 1 and a weight side end 19b fastened to the lower part of the hoisting machine mount 13. Further, the rope 19 is successively wound about a pair of car pulleys 6, the traction sheave 16 and the weight pulley 11 and reaches the weight side end 19b from the car side end 19a in this order. Reference numeral 20 designates a hall floor, and numeral 21 designates a hall door.

[0015] In the above-described elevator, when the counterweight 10 is lowered to its lowermost travelling position to completely compress the weight buffer 12, the car 3 jumps upward as illustrated by the broken lines in Fig. 1, so that a space must be ensured in a part higher than the uppermost travelling position of the car 3. Here, the overhead dimension OH shown in Fig. 1 is expressed as $OH = H1 + d10 + M + d20$.

[0016] In this case, H1 indicates the height from the uppermost hall floor 20 to the uppermost part of the device on the car 3 (here, the roof of the car cabin 5) which comes into closest contact with a device above the car 3 (here, the motor 17) when the car 3 jumps upward. Further, d10 indicates the dimension between the roof of the car cabin 5 and the motor 17 when the car 3 jumps up. M indicates the diameter of the motor 17 (specifically, about 200 mm). Reference symbol d20 indicates the dimension between the uppermost part of the hoisting machine 14 (here, the motor 17) and the ceiling of the hoistway 1.

[0017] If the entire body of the hoisting machine 14 is mounted above the upper part of the car 3, the height of the hoisting machine mount 13 (about 150 mm) and the height of the hoisting machine 14 (about 600 mm) will be added to the overhead dimension. In this case, the diameter of the motor 17 is included in the height of the hoisting machine 14.

[0018] Therefore, according to the elevator of the first embodiment in the present invention, the overhead dimension is decreased by (the height of the hoisting machine mount 13) + (the height of the hoisting machine 14) - (the diameter of the motor 17) in comparison to when the entire body of the hoisting machine 14 is arranged just above the car 3. More specifically, according to the arrangement of the first embodiment, the overhead dimension is decreased by approximately 150mm + 600 mm - 200 mm = 500mm.

[0019] Still further, in the case of the hoisting machine 14 having the reduction gear device 15, the motor 17 which is smaller than the reduction gear device 15 or the traction sheave 16 can be formed. Therefore, even when the hoisting machine mount 13 is not employed, for instance when the hoisting machine 14 is suspended from the ceiling of the hoistway 1, the overhead dimension can be decreased by (the height of the hoisting machine 14) - (the diameter of the motor 17).

[0020] In addition, when the position of the uppermost part of the motor 17 is located at a position lower than the uppermost parts of other parts of the hoisting machine 14, the dimension from the uppermost part of the motor 17 to the uppermost part of the hoisting machine 14 is added to the overhead dimension obtained from the above-described formula. On the contrary, when the position of the uppermost part of the motor 17 is set at a position at the same height as or higher than the uppermost portions of the other parts of the hoisting machine 14, the overhead dimension can be reduced with great efficiency.

[0021] Additionally, as compared with the conventional example in which the hoisting machine 43 is arranged so that it does not overlap the car 44 when the hoisting machine 43 and the car 44 are vertically projected on a horizontal plane as shown in Fig. 5, the floor area of the car cabin 5 can be increased relative to the area of the restricted hoistway in the elevator according to the first embodiment of the present invention.

[0022] Still further, since the hoisting machine mount 13 on which the reduction gear device 15 is mounted is fixed to the upper ends of the weight guide rails 9, the hoisting machine 14 can be arranged by effectively using the space in the upper part of the hoistway 1.

[0023] Further, even though large loads applied to the traction sheave 16 act to overturn the hoisting machine 14, the reduction gear device 15 is firmly fixed to the side wall 1a of the hoistway 1 by the fixing arms 18. More specifically, one end of the fixing arms 18 are fixed to the side wall 1a and the other end of the fixing arms 18 are fixed to the case of the reduction gear device 15, respectively. Thus, overturning of the hoisting machine 14 due to loads applied to the traction sheave 16 can be more assuredly prevented.

Embodiment 2

[0024] In the first embodiment, although the fixing arms 18 are provided between the reduction gear device 15 and the side wall 1a of the hoistway 1, fixing arms 31 may for instance, be provided between the reduction gear device 15 and the car guide rails 2 as shown in Figs. 3 and 4, to prevent the hoisting machine 14 from being overturned.

[0025] Further, in the above first embodiment, although the surface of the motor 17 facing the car 3 is located above the lower ends of the reduction gear device 15 and the traction sheave 16, it should be noted that the present invention is not limited thereto, and for instance, the surface of the motor 17 facing the car 3 may be located above the lower end of the reduction gear device 15 or the traction sheave 16.

Claims

1. An elevator comprising:

a hoistway (1);
a car (3) and a counterweight (10) alternately elevated and lowered in the hoistway (1);
a rope for suspending the car (3) and the counterweight (10) in the hoistway (1); and
a hoisting machine (14), provided in an upper part of the hoistway (1), including a traction sheave (16) on which the rope (19) is wound, a motor (17) for rotating the traction sheave (16), and a reduction gear device (15) connected between the traction sheave (16) and the motor (17), for elevating and lowering the car (3) and the counterweight (10) through the rope (19);
characterized in that when the car (3) and the hoisting machine (14) are vertically projected on a horizontal plane, the reduction gear device (15) and the traction sheave (16) are located outside an area on which the car (3) is projected, and a part of the motor (17) is located inside an area on which the car (3) is projected, respectively, and a surface of the motor (17) facing the car (3) is located above a lower end of at least one of the reduction gear device (15) and the traction sheave (16).

2. An elevator according to Claim 1, wherein a position of an uppermost part of the motor (17) is located at a position at the same height as or higher than the uppermost portions of the other parts of the hoisting machine (14).

3. An elevator according to Claim 1, further comprising:

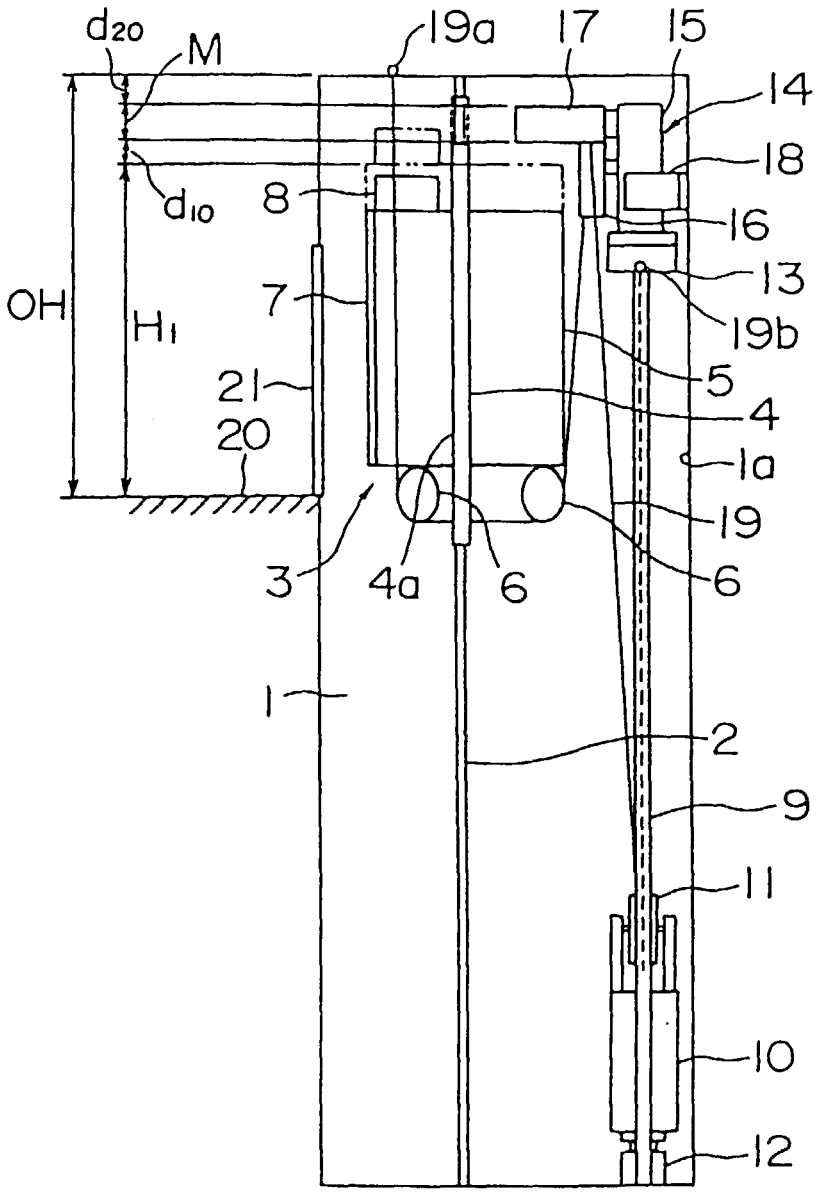
a pair of weight guide rails (9), provided in the hoistway (1), for guiding the counterweight (10) to be elevated and lowered; and

a hoisting machine mount (13) on which the reduction gear device (15) is to be mounted fixed to upper ends of the weight guide rails (9).

4. An elevator according to Claim 3, further including fixing arms (18) secured between the reduction gear device (15) and the side wall (1a) of the hoistway (1).

5. An elevator according to Claim 3, further including: a pair of car guide rails (2), provided in the hoistway (1), for elevating and lowering the car; and fixing arms (31) fixed between the reduction gear device (15) and the car guide rails (2).

FIG. 1


d20
M
19a
17
15
14
18
d10
8
16
13
OH
H1
7
19b
5
21
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19
3
4a
6
6
1
2
9
11
10
12

FIG. 2

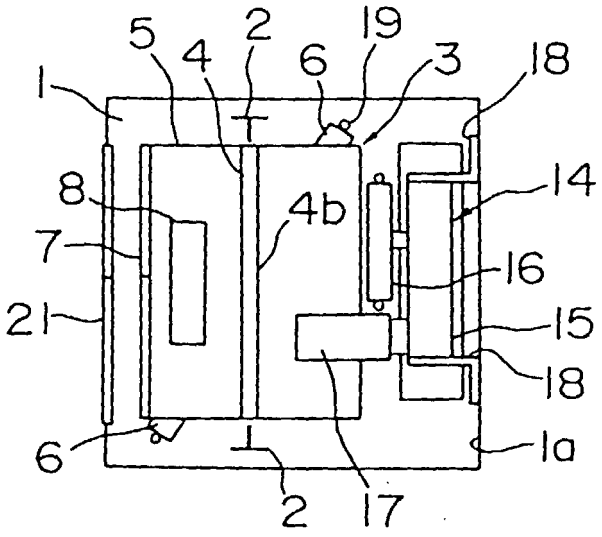

FIG. 3

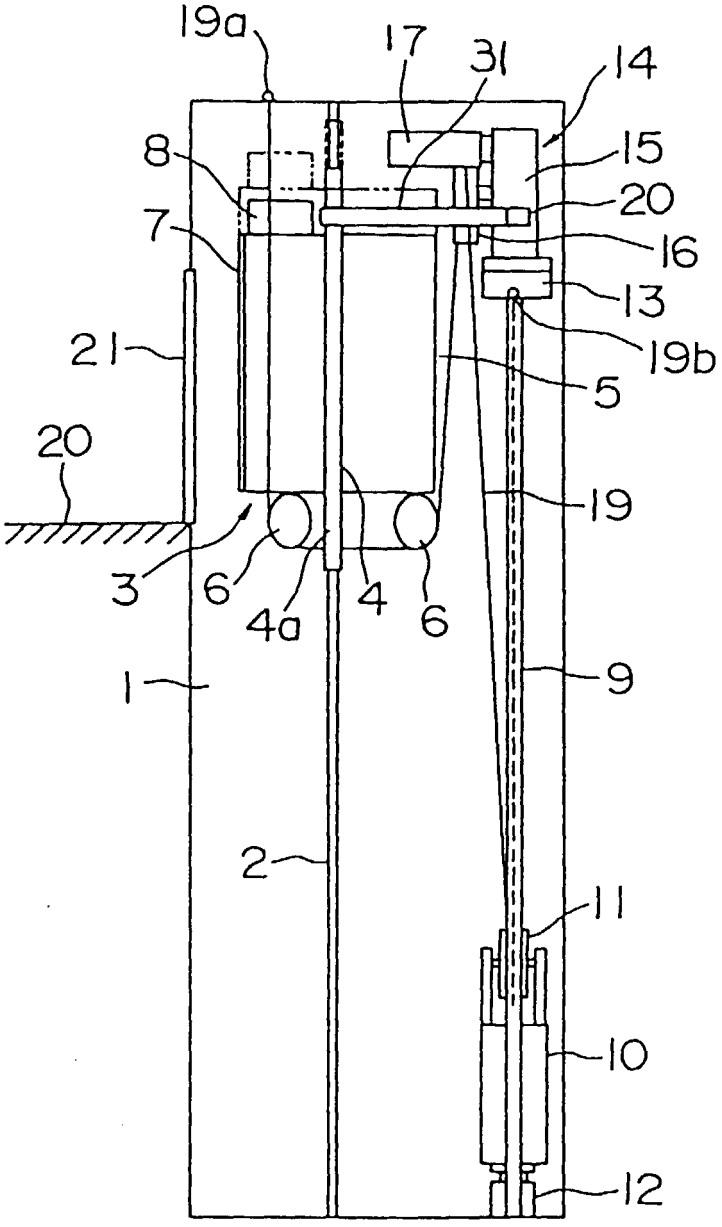

FIG. 4

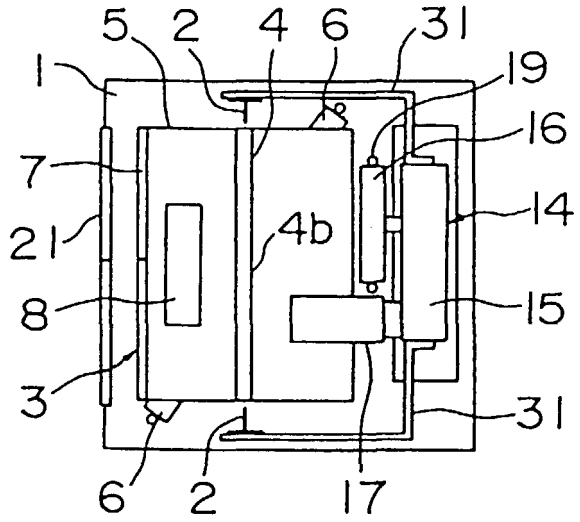

FIG. 5