

Elevator Apparatus

Technical Field

The present invention relates to an elevator apparatus, and in particular to an elevator apparatus capable of making the mechanical beams uniformly stressed and reducing vibration.

Background

There has been known an elevator apparatus, the car of which in a hoistway of a building makes reciprocating lifting movements between the floors to convey people or goods and the like. In such an elevator apparatus, a hoisting machine for driving the elevator car is supported in a machine room at the top of the hoistway, or the hoisting machine is supported above the hoistway of the machine room-less elevator by the mechanical beams.

Further, in such an elevator apparatus, in order to firmly and reliably arrange the hoisting machine and reduce the running vibration of the hoisting machine, the hoisting machine is usually disposed along the mechanical beams, in other words, the hoisting machine is disposed such that its rotating shaft is parallel to the lengthwise direction (long side direction) of the mechanical beam. Also, the center of gravity of the hoisting machine is placed at the supporting center of the mechanical beam.

However, sometimes due to the limitations such as the hoistway structure, the location of the hoisting machine and the like, it is required to configure the rotating shaft of the hoisting machine to have a certain angle with respect to the mechanical beam (orthogonality is common). In this case, the center of gravity of the hoisting machine deviates from the supporting center of the mechanical beam, so that the hoisting machine will generate a certain degree of vibration during operation.

Contents of the Invention

In view of the above circumstances, one object of the present invention is to provide an elevator apparatus capable of making the mechanical beams uniformly stressed and reducing vibration.

The embodiments of the present invention are directed to an elevator apparatus, comprising:

a hoisting machine for driving a car through a main rope;

mechanical beams arranged above a hoistway, having a lengthwise direction orthogonal to a rotating shaft direction of the hoisting machine; and

bearing beams arranged between the hoisting machine and the mechanical beams, having a lengthwise direction parallel to the rotating shaft direction of the hoisting machine.

the hoisting machine is arranged at one end of the bearing beam, and a first hitch plate of the elevator rope is arranged at the other end of the bearing beam.

Further, it is preferable in the elevator apparatus that a double wound sheave for winding the main rope is provided below the mechanical beams.

Further, it is preferable in the elevator apparatus that a second hitch plate of the main rope is provided on the mechanical beams.

Effects of the Invention

In the elevator apparatus of the present embodiment configured as described above, the bearing beams are provided on the mechanical beams disposed at the top of the hoistway, and the hoisting machine for driving the car is provided on the bearing beams, and the lengthwise direction of the hoisting machine is configured to be parallel to the rotating shaft direction of the hoisting machine. Thereby, since the bearing beams are provided between the mechanical beams and the hoisting machine, it is possible to reduce transfer of operation vibration of the hoisting machine to the mechanical beams.

Further, in the elevator apparatus of the present embodiment configured as described above, the hoisting machine is disposed at one end of the bearing beam, and the first hitch plate for fastening the elevator rope is disposed at the other end of the bearing beam, the second hitch plate for fastening the elevator rope is disposed on the mechanical beams, and the double wound sheave of the elevator is disposed below the mechanical beams. Thereby, both the mechanical beams and the bearing beams are stressed uniformly, and so it is possible to further reduce transfer of the operation vibration of the hoisting machine to the mechanical beams and to reduce transfer of the operation vibration of the hoisting machine to the elevator car, thus improving the running smoothness of the elevator and ride comfort.

Description of the Drawings

FIG. 1 is a view showing the overall configuration of an elevator apparatus according to one embodiment.

FIG. 2 is a schematic diagram showing the constitution of a conventional hoisting machine.

FIG. 3 is a schematic diagram showing the constitution of a conventional hoisting machine.

FIG. 4 is a schematic diagram showing the constitution of a hoisting machine according to the embodiment.

Embodiments

The overall configuration of an elevator apparatus 1 and the setting mode of the hoisting machine according to the present embodiment will be described in detail hereinafter with reference to the drawings.

First, the overall configuration of the elevator apparatus 1 according to the present embodiment will be described based on FIG. 1. FIG. 1 is a view showing the overall configuration of the elevator apparatus according to the embodiment.

As shown in FIG. 1, the elevator apparatus 1 of the present embodiment comprises a car 4 and a counterweight 5 disposed in the hoistway 3, and the car 4 is connected with the counterweight 5 via a main rope 9. Disposed above the hoistway 3 is a machine room 6, in which a hoisting machine 2 for driving the main rope 9, a control 8 and the like are provided.

In the present embodiment, the hoisting machine 2 is arranged within the machine room 6 by mechanical beams 11, but in the machine room-less elevator, the mechanical beams 11 also may be disposed at the top of the hoistway 3. Furthermore, connected to one end of a rotating shaft of the hoisting machine 2 is a drive sheave 7, about which the main rope 9 is wound. When the hoisting machine 2 is driven for rotation, the drive sheave 7 also is rotated synchronously so as to drive the main rope 9, thereby moving the car 4 and the counterweight 5 up and down along the hoistway 3. Thus, under the control of the control 8, the car 4 is driven to a predetermined floor and stopped for a predetermined period of time.

Next, the setting modes of the hoisting machine in the conventional elevator apparatus will be described with reference to FIGS. 2 and 3. FIG. 2 is a schematic diagram showing the constitution of a conventional hoisting machine. FIG. 3 is a schematic diagram showing the constitution of a conventional hoisting machine.

As shown in FIGS. 2 and 3, in the conventional elevator apparatus, a plurality of mechanical beams 12 are arranged on a setting table at the top of the elevator hoistway,

and then the hoisting machine 2 is disposed onto the mechanical beams 12 via a frame 14. Further, in order to reduce the vibration generated when the hoisting machine 2 operates, it is preferable to arrange the hoisting machine 2 at the substantially central portion of the mechanical beams 12, as shown in FIG. 2, and to make the rotating shaft of the hoisting machine 2 parallel to the lengthwise direction of the mechanical beams 12.

However, due to the differences in the structure of the hoistway 3 and the structure of the hoisting machine 2 and the like, sometimes it is impossible to arrange the hoisting machine 2 at the substantially central portion of the mechanical beams 12, and to make the rotating shaft of the hoisting machine 2 parallel to the lengthwise direction of the mechanical beams 12. In such a case, sometimes it is necessary to make the rotating shaft of the hoisting machine 2 and the lengthwise direction of the mechanical beams 12 intersect, as shown in FIG. 3 (in the present embodiment, the case of orthogonality is taken as an example), and sometimes it also is required to dispose the hoisting machine 2 at the ends of the mechanical beams 12 in the lengthwise direction thereof by way of the frame 14. Here, in order to make the mechanical beams 12 stressed more uniformly, a double wound sheave 10 for winding the elevator rope is usually disposed at the other end in the lengthwise direction opposite to the one end where the hoisting machine 2 is proceed. However, even in this case, a certain degree of vibration may occur when the hoisting machine 2 operates.

Here, in order to make the mechanical beams of the elevator apparatus stressed more uniformly and to further reduce the vibration during the operation of the hoisting machine, the inventors of the present invention have improved the arrangement of the hoisting machine and the mechanical beams.

The contents of the invention will be specifically described hereinafter with reference to FIG. 4. FIG. 4 is a schematic diagram showing the constitution of a hoisting machine according to the embodiment.

As shown in FIG. 4, in the present embodiment, at first, a plurality of mechanical beams 11a, 11b, and 11c are provided in order to dispose the hoisting machine 2, the control 8 and so on, like the case in the above-mentioned conventional elevator apparatus. These mechanical beams 11a, 11b and 11c are arranged at the top of the hoistway 3 of the machine room-less elevator. Further, as shown in FIG. 4, this embodiment takes three mechanical beams 11a, 11b and 11c as an example, but any other number of mechanical beams also may be used depending on the specifications of the mechanical beams, the different setting conditions in the hoistway, and the like.

Further, similarly to the case of the above-described conventional elevator apparatus, a double wound sheave 10 for winding the main rope 9 is provided at the lower portions of the mechanical beams 11a, 11b, and 11c. Moreover, in the elevator apparatus of the embodiment, a double wound sheave 10 is disposed between the mechanical beams 11a, 11b at the ends in the lengthwise direction thereof. In this case, since the main rope 9 is wound about the double wound sheave 10, and the car 4 and the counterweight 5 are respectively connected to both ends of the main rope 9, the double wound sheave 10 exerts a downwardly-directed tensile force on the mechanical beams 11a, 11b.

Furthermore, in the elevator apparatus of this embodiment, a hitch plate 13a is disposed between the mechanical beams 11b and 11c at the ends in the lengthwise direction thereof, and the hitch plate 13a and the double wound sheave 10 are disposed at the same end side in the lengthwise direction of the mechanical beams 11a, 11b, 11c. In this case, since the end of the main rope is secured on the hitch plate 13a and the main rope 9 in turn is connected to the counterweight 5, the hitch plate 13a applies a downwardly-directed tensile force to the mechanical beams 11b, 11c.

Further, on these mechanical beams 11a, 11b and 11c, bearing beams 12a, 12b are fixedly disposed at the substantially central positions thereof. The bearing beams 12a, 12b are configured such that their lengthwise direction intersects with the lengthwise direction of the mechanical beams 11a, 11b, 11c (being orthogonal in this embodiment). In addition, as shown in FIG. 4, this embodiment takes two bearing beams 12a and 12b as an example, but any other number of bearing beams also may be used depending on the specifications of the bearing beams, the different setting conditions of the hoisting machine, and the like.

Further, as shown in FIG. 4, a hoisting machine 2 is disposed at the ends of the bearing beams 12a, 12b thereof in the lengthwise direction in such a way of spanning the bearing beams 12a, 12b by way of the frame 14. The direction of the rotating shaft of the hoisting machine 2 is parallel to the lengthwise direction of the bearing beams 12a, 12b, that is, the direction of the rotating shaft of the hoisting machine 2 also is orthogonal to the lengthwise direction of the mechanical beams 11a, 11b, 11c. Here, the weight of the hoisting machine 2 and the bearing beams 12a, 12b exerts a downward force on the mechanical beams 11a, 11b, 11c.

Further, in this embodiment, one end of the rotating shaft of the hoisting machine 2 projects toward the outer side of the mechanical beams 11a. When viewed from Fig. 4, one end of the rotating shaft of the hoisting machine 2 projects toward the inner side of the paper plane. Disposed on the projecting end of the rotating shaft is a drive sheave 7 for

winding and driving the main rope 9, and hereby the elevator car 4 and the counterweight 5 are driven by the hoisting machine 2 via the drive sheave 7 and the main rope 9.

Further, in this embodiment, a hitch plate 13b is disposed at the other ends of the bearing beams 12a, 12b in the lengthwise direction thereof. At the end of the hitch plate 13b where the main rope 9 is fastened, the main rope 9 is connected to the car 4, and so the hitch plate 13b applies a downwardly-directed tensile force to the bearing beams 12a, 12b.

As described above, the hoisting machine 2 is arranged at the ends of the bearing beams 12a and 12b in the lengthwise direction thereof, and the hitch plate 13b is arranged at the other ends of the bearing beams 12a and 12b in the lengthwise direction. Thus, the downward force exerted on the hoisting machine 2 by the weight of the hoisting machine 2 and the main rope 9 via the drive sheave 7 and the downward force exerted on hitch plate 13b by the elevator car via the rope are evenly applied to both ends of the bearing beams 12a, 12b to a certain degree. Whereby, the downward forces experienced by bearing beams 12a, 12b along the lengthwise direction become substantially uniform, and so the bearing beams 12a, 12b become stable and hardly a positional deviation is generated, so that it is difficult to generate the vibration.

Further, as described above, on the mechanical beams 11a, 11b and 11c, the hoisting machine 2 and the hitch plate 13b are disposed at the substantially central parts by way of the bearing beams 12a, 12b, and the hitch plate 13a and the double wound sheave 10 are disposed at the ends thereof in the lengthwise direction. Thus, the downward tensile force experienced by the hitch plate 13a and double wound sheave 10 and the resultant force of the weight of the hoisting machine 2 and hitch plate 13b and the downward tensile force experienced by them are evenly applied to the mechanical beams 11a, 11b and 11c to a certain degree. In this way, the downward forces received by the mechanical beams 11a, 11b, 11c in the lengthwise direction become substantially uniform, and so the mechanical beams 11a, 11b, 11c become stable and hardly a positional deviation is generated, so that it is difficult to generate the vibration.

In addition, in order to further reduce the transfer of vibration, a cushioning pad (not shown) or the like may be provided between the frame 14 and the bearing beams 12a, 12b, or cushioning pads (not shown) may be further provided between the bearing beams 12a, 12b and the mechanical beams 11a, 11b, 11c, and between the mechanical beams 11a, 11b, 11c and setting table at the top of the hoistway 3. In this way, the vibration of the hoisting machine 2 during operation will be partially absorbed by these cushioning pads.

Further, as described above, since the mechanical beams 11a, 11b, 11c and the bearing beams 12a, 12b are stably secured, the positions of both the mechanical beams 11a, 11b, 11c and the bearing beams 12a, 12b per se are hardly displaced, and it is difficult to generate vibration, and furthermore this makes it difficult to transfer the vibration of the hoisting machine 2 during operation to the bearing beams 12a, 12b and the mechanical beams 11a, 11b, 11c.

In addition, since the mechanical beams 11a, 11b, 11c are uniformly stressed along the lengthwise direction thereof and the bearing beams 12a, 12b also are uniformly stressed along the lengthwise direction thereof, the overall configuration for arranging the hoisting machine 2 at the top of the hoistway 3 is subjected to the uniform stress, and it is difficult to generate vibration due to the uneven stress. Thus, transmission of the vibration to the car 4 through the main rope 9 is reduced, as a result of which it is advantageous to reduction in vibration of the elevator car and to improvement of the stability of the elevator during operation and the comfort of passengers.

Further, in the conventional elevator apparatus, the hoisting machine is directly disposed on the mechanical beams, so that at the time of setting the hoisting machine, the arranging position of the hoisting machine can be adjusted along the lengthwise direction of the mechanical beams. On the contrary, in the elevator apparatus of the present embodiment, the hoisting machine is disposed on the mechanical beams via the bearing beams. Thus, at the time of setting the hoisting machine, not only the position of the hoisting machine can be adjusted along the lengthwise direction of the bearing beams, but also the position of the bearing beams can be adjusted along the lengthwise direction of the mechanical beams, as a result of which it is possible to regulate the position of the hoisting machine in the plane, and so to arrange the hoisting machine at a more suitable position.

In addition, in the above-described embodiment, the setting mode of the hoisting machine has been schematically described. However, those skilled in the art can appropriately change the setting mode of the hoisting machine based on the outline of the above embodiment. Concretely, in terms of the arranging position, the hoisting machine 2 may be located at the substantially central part of the bearing beams, instead of the ends of the bearing beams. In this case, the hitch plate 13b is not located at the other ends of the bearing beams, but at the ends of the mechanical beams, i.e., these ends opposite to the ends at which the hitch plate 13a is provided. Thereby, the force applied to the entire hoisting machine 2 can be made uniform, and it is difficult to generate the vibration due to

uneven stress.

Further, in the above description, the end of the hoisting machine for arranging the drive sheave thereon protrudes toward the outside of the mechanical beams, but the end of the hoisting machine for arranging the drive sheave also may be configured to project toward the opposite side, that is, it is also possible to have the drive sheave located above a space between the mechanical beams 11a and 11b, and so the main rope 9 is passed between the mechanical beams 11a and 11b and wound onto the drive sheave. As a result, the force applied to the entire hoisting machine 2 can be made uniform, and it is difficult to generate the vibration due to uneven stress.

Several embodiments of the present invention have been described above, as examples only, but are not intended to limit the protection scope. These embodiments can be carried out in other various modes, and various omissions, substitutions and modifications can be made without departing from the spirit of the invention. These embodiments and modifications thereof are intended to be included within the scope and spirit of the invention, and within the scope defined by the claims of the invention and equivalents thereof.

CLAIMS

1. An elevator apparatus, characterized by comprising:
a hoisting machine (2) for driving a car (4) through a main rope (9);
mechanical beams (11a, 11b, 11c) arranged above a hoistway (3), having a lengthwise direction orthogonal to a rotating shaft direction of the hoisting machine (2);
and
bearing beams (12a, 12b) arranged between the hoisting machine (2) and the mechanical beams (11a, 11b, 11c), having a lengthwise direction parallel to the rotating shaft direction of the hoisting machine (2),
wherein the hoisting machine (2) is arranged at one end of the bearing beam (12a, 12b), and a first hitch plate (13b) of the elevator rope (9) is arranged at the other end of the bearing beam (12a, 12b).
2. The elevator apparatus according to claim 1, characterized by further comprising:
a double wound sheave (10) for winding the main rope (9) that is provided below the mechanical beams (11a, 11b).
3. The elevator apparatus according to claim 1 or 2, characterized in that,
a second hitch plate (13a) of the main rope (9) is provided on the mechanical beams (11b, 11c).