provided above the entrance of the elevator car, ~~; and the upper part of a drive motor-bracket structure is inclined.~~

~~[0013]~~

~~According to such a configuration, since the upper part of the drive motor-bracket structure is inclined, the elevator maintenance staff, when stepping on the elevator car in maintenance checks for the elevator, cannot put a foot on the upper part of the drive motor-bracket structure well, despite attempts. Since the maintenance staff would avoid such attempts, it is possible to prevent the drive motor-bracket structure from being used as a foothold suitably.~~

~~[0014]~~

~~The elevator door opening and closing device according to the present invention may have a configuration in which~~ the bracket is attached to the front of the upper frame while being inclined about an axis orthogonal to the front of the upper frame, and the drive motor is attached to the lower surface of the bracket.

[00~~15~~13]

According to such a configuration, since the bracket is inclined about an axis orthogonal to the front of the upper frame, and the drive motor is located below the bracket, the upper part of the drive motor-bracket structure, that is, the upper surface of the bracket is inclined. Therefore, the elevator maintenance staff, when stepping on the elevator car in maintenance checks for the elevator, cannot put a foot on the upper surface of the bracket well, despite attempts. Since the maintenance staff would avoid such attempts, it is possible to prevent the bracket from being used as a foothold suitably.

[00~~16~~14]

In this case, the bracket is preferably attached to the front of the upper frame so that the attached portion to the front of the upper frame and the attached portion to the drive motor are arranged inwardly of an opening line that defines the front width of the entrance of the elevator car.

[00~~17~~15]

According to such a configuration, the work to detach the bracket from the front of the upper frame or the work to detach the drive motor from the bracket can be performed from the position of the platform with the platform door open. Therefore, the working efficiency of such works can be enhanced.

[00~~18~~16]

Further, the elevator door opening and closing device according to the present invention can be configured so that the bracket has an inclined portion that is inclined with respect to ~~an axis~~ a horizontal direction orthogonal to the front of the upper frame, and the drive motor is attached to the lower surface of the bracket.

[00~~19~~17]

According to such a configuration, the bracket has an inclined portion that is inclined with respect to ~~an axis~~ a horizontal direction orthogonal to the front of the upper frame, and the drive motor is located below the bracket, thereby allowing the upper part of the drive motor-bracket structure, that is, the upper surface of the bracket to be inclined. Therefore, the maintenance staff, when stepping on the elevator car in maintenance checks for the elevator, cannot put a foot on the upper surface of the bracket well, despite attempts. Since the maintenance staff would avoid such attempts, it is possible to prevent the bracket from being used as a foothold suitably.

[00~~20~~18]

Further, the elevator door opening and closing device according to the present invention may have a configuration in which the drive motor includes a housing formed into a circular or substantially circular shape, and the drive motor is attached onto the upper surface of the bracket.

[00~~21~~19]

According to such a configuration, the housing of the drive motor is formed into a circular or substantially circular shape so that the drive motor has a rounded contour, and the drive motor is located above the bracket, ~~thereby allowing the upper part of the drive motor-bracket structure, that is, the outer surface of the drive motor to be inclined. Therefore,~~ and accordingly,

the maintenance staff, when stepping on the elevator car in maintenance checks for the elevator, cannot put a foot on the outer surface of the drive motor well, despite attempts. Since the maintenance staff would avoid such attempts, it is possible to prevent the drive motor from being used as a foothold suitably.

[00~~22~~20]

In the elevator door opening and closing device according to the present invention, it is preferable that the transmission mechanism includes: a drive pulley attached on one end side of the front of the upper frame; a driven pulley attached on the other end side of the front of the upper frame; and an endless drive belt that is wound and hung around the drive pulley and the driven pulley and that engages the car door, and the drive motor is attached to the front of the upper frame so as to have a direct connection with the drive pulley.

[00~~23~~21]

According to such a configuration, it is possible to eliminate the motor pulley, the reduction pulley, and the reduction belt from the configuration of the conventional door opening and closing device, which makes it possible not only to improve maintenance performance, but also to reduce the man-hours or cost through the reduction in the number of parts.

Advantageous Effects of Invention

[00~~24~~22]

As seen from the above, the present invention can suitably prevent the drive motor-bracket structure from being used as a foothold in maintenance checks for the elevator, even if the drive motor is attached to the front of the upper frame via the bracket for the purpose of reducing the total height of the elevator car, because the upper part of the drive motor-bracket structure is inclined.

BRIEF DESCRIPTION OF DRAWINGS

[00~~25~~23]

FIG. 1 is a front view of an elevator car according to one embodiment with car doors closed.

FIG. 2 is a side view on the front side of the elevator car.

FIG. 3 is a front view of the elevator car with the car doors open.

FIG. 4 is a front view of a main part of a door opening and closing device provided at an upper part of the elevator car.

FIG. 5 is a sectional view taken along the line A-A of FIG. 4, and shows an attached state of a drive motor in the door opening and closing device.

FIG. 6 is a view showing an attached state of a drive motor according to another embodiment.

FIG. 7 is a view showing an attached state of a drive motor according to still another embodiment.

FIG. 8 is a sectional plan view of a conventional elevator.

FIG. 9 is a front view of the elevator car of the elevator.

DESCRIPTION OF EMBODIMENTS

[00~~26~~24]

Hereinafter, one embodiment of the elevator door opening and closing device according to the present invention is described with reference to the drawings. It should be noted that, among the components described in this embodiment, components identical or corresponding to those in the conventional technique shown in FIG. 8 and FIG. 9 are denoted by the same reference numerals.

[00~~27~~25]

First, the elevator according to this embodiment is schematically described with reference to FIG. 1 to FIG. 3. The elevator according to this embodiment is a so-called side opening elevator in which the entrance 7 of the elevator car 6 is opened from one end. That is, the elevator according to this embodiment has a structure in which a pair of car doors 8 move in the same direction, where one of the car doors 8 moves more than the other of the car doors 8. The one of the car doors 8 moves more, that is, moves at a higher

speed, and therefore is commonly called a "fast door". The other of the car doors 8 moves less, that is, moves at a lower speed, and therefore is commonly called a "slow door". Hereinafter, components of the fast door are denoted by the reference numerals followed by the letter "f", and components of the slow door are denoted by the reference numerals followed by the letter "s", for convenience of description.

[00~~28~~26]

A car door 8f is hung from a door rail 11f via a door hanger 12f by mounting a pair of rollers 13f attached to the door hanger 12f on the door rail 11f. Further, a car door 8s is hung from a door rail 11s via a door hanger 12s by mounting a pair of rollers 13s attached to the door hanger 12s on the door rail 11s. The door rail 11s is directly attached to the front of the upper frame 10. On the other hand, the door rail 11f is attached to the front of the upper frame 10 via a bracket 14. Accordingly, the door rail 11s is first arranged and the door rail 11f is then arranged in front of the upper frame 10. Therefore, the car door 8f is arranged at a position offset toward the front side more than the car door 8s. Accordingly, when the car doors 8f and 8s are opened, they overlap each other so that the car door 8f covers the car door 8s.

[00~~29~~27]

The car door 8f is coupled to the drive belt 36 of the door opening and closing device via the door hanger 12f and the coupling tool 37 attached to the door hanger 12f in the same manner as in the center opening type. On the other hand, the car door 8s is coupled to the car door 8f via a reduction mechanism.

[00~~30~~28]

The reduction mechanism includes: an arm 15 that extends along the front width direction of the entrance 7 of the elevator car 6 and is attached to the door hanger 12s of the car door 8s; a pair of reduction pulleys 16 that are respectively attached on one end side and the other end side of the arm 15; a reduction wire 17 that is composed of an endless wire and is wound and hung around the pair of reduction pulleys 16; and a bracket 18 that is attached to the

front of the upper frame 10 so as to fix a part of the reduction wire 17 to the upper frame 10. The car door 8f is coupled to the reduction wire 17 of the reduction mechanism via the door hanger 12f and a coupling tool 38 attached to the door hanger 12f.

[00~~31~~29]

Accordingly, when the drive belt 36 is circulated by the drive motor 30, the car door 8f moves along the door rail 11f via the door hanger 12f. Simultaneously, the reduction wire 17 is circulated, and following this, the car door 8s moves along the door rail 11s via the arm 15 and the door hanger 12s at the half speed of the car door 8f. Thus, the car doors 8f and 8s are opened and closed.

[00~~32~~30]

A guide shoe 19 is provided at the lower end of each of the car doors 8f and 8s. The guide shoe 19 is fitted into a groove formed on a car threshold (car floor) 20, and is configured to slide inside the groove with the opening and closing of the car doors 8f and 8s.

[00~~33~~31]

Here, the door opening and closing device according to this embodiment includes: the drive motor 30 arranged on one end side of the front of the upper frame 10; the drive pulley 33 attached to the drive shaft of the drive motor 30; the driven pulley 34 attached on the other end side of the front of the upper frame 10; and the drive belt 36 that is composed of an endless belt and is wound and hung around the drive pulley 33 and the driven pulley 34.

[00~~34~~32]

The drive motor 30 is attached to the front of the upper frame 10 via a bracket 39, as shown in FIG. 4 and FIG. 5. Therefore, it is possible to reduce the total height of the elevator car 6 as compared to the above-mentioned conventional door opening and closing device in which the drive motor 30 is attached onto the upper surface of the upper frame 10.

[00~~35~~33]

Further, the drive motor 30 is a so-called direct drive motor and has a

drive shaft with which the drive pulley 33 is directly connected. Accordingly, it is possible to eliminate the motor pulley 31, the reduction pulley 32, and the reduction belt 35 from the configuration of the above-mentioned conventional door opening and closing device, which makes it possible not only to improve maintenance performance, but also to reduce the man-hours or cost through the reduction in the number of parts.

[00~~36~~34]

The bracket 39 includes a base 39a and an extending portion 39b connected to the base 39a and extending from the base 39a. The base 39a has a flat plate shape, and the extending portion 39b also has a flat plate shape. The extending portion 39b is formed into an L shape in the cross section by having its base end connected to the tip of the base 39a (orthogonally).

[00~~37~~35]

The base 39a has a through hole formed at an appropriate point. The bracket 39 is attached to the front of the upper frame 10 using a fastener 40 by passing a bolt through the above-mentioned through hole and another through hole formed in the upper frame 10 and fastening a nut. In this embodiment, a plurality of through holes are formed at intervals in an arcuate manner with the drive shaft of the drive motor 30 at the center.

[00~~38~~36]

Also in the extending portion 39b, a through hole is formed at an appropriate point. The drive motor 30 is attached to the lower surface of the bracket 39 via a collar 41 using a fastener 42 by passing a bolt through the through hole and another through hole formed in the collar 41 interposed between the extending portion 39b and the drive motor 30, and screwing the bolt into an internal thread formed in the housing of the drive motor 30. The collar 41 is interposed therebetween in order to absorb the difference in shape between the lower surface of the extending portion 39b, which is flat, and the outer surface of the housing of the drive motor 30, which is round. The collar 41 has surfaces facing each other, among which one is a flat surface and the other is a concave arcuate surface. Further, in this embodiment, the drive

motor 30 is attached to the front of the upper frame 10 so that the drive pulley 33 faces the front of the upper frame 10. Further, in this embodiment, a plurality of through holes are formed at intervals in the direction of the drive shaft of the drive motor 30.

[00~~39~~37]

The bracket 39 is attached to the front of the upper frame 10 while being inclined about an axis orthogonal to the front of the upper frame 10. In detail, the bracket 39 is attached to the front of the upper frame 10 so that the attached portion to the front of the upper frame 10 is arranged inwardly of an opening line L (more on the entrance 7 side) that defines the front width of the entrance 7 of the elevator car 6. Specifically, the bracket 39 is attached to the front of the upper frame 10 so that a plurality of fasteners 40 for fixing the bracket 39 to the front of the upper frame 10 are all arranged inwardly of the opening line L (more on the entrance 7 side).

[004~~0~~38]

Further, the bracket 39 is attached in such an inclined state, as a result of which the attached portion of the drive motor 30 also is arranged inwardly of the opening line L (more on the entrance 7 side). Specifically, a plurality of fasteners 42 for fixing the drive motor 30 to the bracket 39 are all arranged inwardly of the opening line L (more on the entrance 7 side).

[004~~1~~39]

According to the door opening and closing device of this embodiment mentioned above, the bracket 39 is inclined about an axis orthogonal to the front of the upper frame 10, and the drive motor 30 is located below the bracket 39, thereby allowing the upper part of the drive motor 30-bracket 39 structure, that is, the upper surface of the bracket 39 to be inclined. Therefore, when the maintenance staff steps on the elevator car 6 in maintenance checks for the elevator with the elevator car 6 being lowered from the position of the platform 3 to a position such that the maintenance staff can step on the elevator car 6, the maintenance staff cannot put a foot on the upper surface of the bracket 39 well, despite attempts. Since the maintenance staff would avoid such

attempts, it is possible to prevent the bracket 39 from being used as a foothold suitably.

[00~~42~~40]

Therefore, according to the door opening and closing device of this embodiment, it is also possible to suitably prevent malfunction of the door opening and closing device, which occurs as follows: an excessive load is applied to the bracket 39; the bracket 39 is bent; the drive motor 30 is tilted; and the center of the drive shaft (drive pulley 33) of the drive motor 30 displaced.

[00~~43~~41]

Further, according to the door opening and closing device of this embodiment, the bracket 39 is attached to the front of the upper frame 10 so that the attached portions to the front of the upper frame 10 (portions attached using the fasteners 40) and the attached portions of the drive motor 30 (portions attached using the fasteners 42) are arranged inwardly of the opening line L, thereby allowing the work to detach the drive motor 30 from the bracket 39, or the subsequent work to detach, from the front of the upper frame 10, the bracket 39 from which the drive motor 30 has been detached to be performed from the position of the platform 3 with the platform door 4 open. Therefore, the working efficiency of such works can be enhanced.

[00~~44~~42]

It should be noted that the elevator door opening and closing device according to the present invention is not limited to the above-mentioned embodiments, and various modifications can be made without departing from the gist of the present invention.

[00~~45~~43]

For example, in the above-mentioned embodiments, the bracket 39 is attached in a wholly inclined state. However, it is also possible that the bracket 39 as a whole is attached in a horizontal state, instead of which the extending portion 39b is inclined with respect to the base 39a. Specifically, the extending portion 39b is wholly inclined with respect to the base 39a, or at least the tip side 39b' of the extending portion 39b is inclined with respect to the base

39a, as shown in FIG. 6.

[00~~46~~44]

According to such a configuration, the bracket 39 has the inclined portion 39b' that is inclined with respect to ~~an axis~~ a horizontal direction orthogonal to the front of the upper frame 10, and the drive motor 30 is located below the bracket 39, thereby allowing the upper part of the drive motor 30-bracket 39 structure, that is, the upper surface of the bracket 39 to be inclined. Therefore, when the maintenance staff steps on the elevator car 6 in maintenance checks for the elevator with the elevator car 6 being lowered from the position of the platform 3 to a position such that the maintenance staff can step on the elevator car 6, the maintenance staff cannot put a foot on the upper surface of the bracket 39 well, despite attempts. Since the maintenance staff would avoid such attempts, it is possible to prevent the bracket 39 from being used as a foothold suitably. Further, since each fastener 42 is oriented to the front side, the working efficiency of the work, for example, to fasten or loosen the fastener 42 can be enhanced.

[00~~47~~45]

In the case of employing this configuration, the housing of the drive motor 30 is formed so as to have a portion formed into an inclined surface, or the collar 41 is formed so as to have surfaces facing each other, among which one is an inclined surface and the other is a concave arcuate surface, with the housing of the drive motor 30 as it is in the above-mentioned embodiments, so that the drive motor 30 is attached in a correct posture (in a horizontal posture in which the drive shaft of the drive motor 30 is horizontal) to the extending portion 39b that is inclined.

[00~~48~~46]

Further, such a configuration can be used in combination with the configuration of the above-mentioned embodiments. That is, it is also possible that the bracket 39 is attached to the front of the upper frame 10, while having the inclined portion 39b' that is inclined with respect to an axis direction orthogonal to the front of the upper frame 10 and being inclined about an axis

orthogonal to the front of the upper frame 10, and the drive motor 30 is attached to the lower surface of the bracket 39 (inclined portion 39b').

[00~~49~~47]

Further, in the above-mentioned embodiments, the bracket 39 is attached in a wholly inclined state. However, it is also possible that the drive motor 30 is attached onto the upper surface of the extending portion 39b of the bracket 39 (via the collar 41), with the bracket 39 as a whole being attached in a horizontal state, as shown in FIG. 7.

[00~~50~~48]

According to such a configuration, the housing of the drive motor 30 is formed into a circular or substantially circular shape so that the drive motor 30 has a rounded contour, and the drive motor 30 is located above the bracket 39, thereby allowing the upper part of the drive motor 30-bracket 39 structure, that is, the outer surface of the drive motor 30 to be inclined. Therefore, when the maintenance staff steps on the elevator car 6 in maintenance checks for the elevator with the elevator car 6 being lowered from the position of the platform 3 to a position such that the maintenance staff can step on the elevator car 6, the maintenance staff cannot put a foot on the outer surface of the drive motor 30 well, despite attempts. Since the maintenance staff would avoid such attempts, it is possible to prevent the drive motor 30 from being used as a foothold suitably.

[00~~51~~49]

Further, although the side opening type is employed in the above-mentioned embodiments, the center opening type may be employed as in the above-mentioned conventional elevator. Furthermore, the side opening elevator provided with three or more car doors 8, instead of two car doors 8 may be employed. Also, the center opening elevator provided with two car doors 8 on each side may be employed.

[00~~52~~50]

Further, the drive shaft of the drive motor 30 is directly connected with the drive pulley 33 that rotates the drive belt 36 in the above-mentioned

embodiments. However, instead of such a direct drive system, it is also possible to employ a mechanism as in the conventional door opening and closing device in which the drive motor 30 is arranged at a distance from the drive pulley 33, the motor pulley is attached to the drive shaft of the drive motor 30, the reduction pulley is coaxially and integrally attached to the drive pulley 33, and the reduction belt is wound and hung around the motor pulley and the reduction pulley.

[00~~53~~51]

Further, in the above-mentioned embodiments, the drive pulley 33, the driven pulley 34, the drive belt 36, and the coupling tool 37 are combined as a transmission mechanism for transmitting the driving force of the drive motor 30 to the car door 8. Besides that, publicly known transmission mechanisms such as a link mechanism can be employed.

[00~~54~~52]

Further, although the housing of the drive motor 30 is formed into a circular shape in the above-mentioned embodiments, its shape may not be strictly circular, and includes elliptical shapes and polygon shapes such as a hexagonal shape and an octagonal shape.

[00~~55~~53]

Further, although the upper frame 10 is composed of a perpendicular portion 10a and a horizontal portion 10b extending backward from the upper end of the perpendicular portion 10a in the above-mentioned embodiments, the horizontal portion 10b may be eliminated.

REFERENCE SIGNS LIST

[00~~56~~54]

1: Shaft

2: Entrance

3: Platform

4: Platform door

5: Engagement receiving portion

6: Elevator car

7: Entrance

8: Car door

9: Engaging portion

10: Upper frame

10a: Perpendicular portion

10b: Horizontal portion

11: Door rail

12: Door hanger

13: Roller

14: Bracket

15: Arm

16: Reduction pulley

17: Reduction wire

18: Bracket

19: Guide shoe

20: Car threshold

30: Drive motor

33: Drive pulley

34: Driven pulley

36: Drive belt

37, 38: Coupling tool

39: Bracket

39a: Base

39b: Extending portion

40: Fastener

41: Collar

42: Fastener

L: Opening line

CLAIMS

~~1. An elevator door opening and closing device in which an openable and closable car door is provided at an entrance of an elevator car, and a drive motor is coupled to the car door via a transmission mechanism, characterized in that:~~

~~the drive motor is attached via a bracket to a front of an upper frame provided above the entrance of the elevator car; and~~

~~an upper part of a drive motor-bracket structure is inclined.~~

1.~~2.~~ ~~The~~ An elevator door opening and closing device ~~according to claim 1, wherein~~ in which an openable and closable car door is provided at an entrance of an elevator car, and a drive motor is coupled to the car door via a transmission mechanism, characterized in that:

the drive motor is attached via a bracket to a front of an upper frame provided above the entrance of the elevator car;

the bracket is attached to the front of the upper frame while being inclined about an axis orthogonal to the front of the upper frame~~,~~ ; and

the drive motor is attached to a lower surface of the bracket.

2.~~3.~~ The elevator door opening and closing device according to claim ~~2~~ 1, wherein

the bracket is attached to the front of the upper frame so that an attached portion to the front of the upper frame and an attached portion of the drive motor are arranged inwardly of an opening line that defines a front width of the entrance of the elevator car.

3.~~4.~~ ~~The~~ An elevator door opening and closing device ~~according to claim 1, wherein~~ in which an openable and closable car door is provided at an entrance of an elevator car, and a drive motor is coupled to the car door via a transmission mechanism, characterized in that:

the drive motor is attached via a bracket to a front of an upper frame

provided above the entrance of the elevator car;

the bracket has an inclined portion that is inclined with respect to ~~an axis~~ a horizontal direction orthogonal to the front of the upper frame~~,~~; and

the drive motor is attached to a lower surface of the bracket.

4.~~5.~~ ~~The~~ An elevator door opening and closing device ~~according to claim 1, wherein~~ in which an openable and closable car door is provided at an entrance of an elevator car, and a drive motor is coupled to the car door via a transmission mechanism, characterized in that:

the drive motor is attached via a bracket to a front of an upper frame provided above the entrance of the elevator car;

the drive motor comprises a housing formed into a circular or substantially circular shape~~,~~; and

the drive motor is attached to an upper surface of the bracket.

5.~~6.~~ The elevator door opening and closing device according to any one of claims 1 to ~~5~~ 4, wherein

the transmission mechanism comprises: a drive pulley attached on one end side of the front of the upper frame; a driven pulley attached on the other end side of the front of the upper frame; and an endless drive belt that is wound and hung around the drive pulley and the driven pulley and that engages the car door, and

the drive motor is attached to the front of the upper frame so as to have a direct connection with the drive pulley.