

DESCRIPTION

ELEVATOR DOOR OPENING AND CLOSING DEVICE

5 FIELD

[0001]

The present invention relates to an elevator door opening and closing device that opens and closes a car door of an elevator car.

10 BACKGROUND

[0002]

An elevator has a structure, as shown in FIG. 8, in which a shaft 1 is provided in a building, an entrance 2 is provided at a desired height position of the shaft 1, a platform 3 is provided facing the entrance 2, a platform door 4 is provided at the entrance 2, an elevator car 6 is provided in the shaft 1 so as to be vertically moved by a drive unit (not shown), an entrance 7 is provided in the elevator car 6, and a car door 8 is provided at the entrance 7. A common elevator has a structure in which an engaging portion 9 is provided at the car door 8 so as to project toward the platform door 4, an engagement receiving portion 5 is provided at the platform door 4 so as to project toward the car door 8. The engaging portion 9 and the engagement receiving portion 5 engage each other upon the arrival of the elevator car 6 at the position of the platform 3. Thus, when the car door 8 is opened and closed by a door opening and closing device provided on the elevator car 6 side, the platform door 4 is opened and closed accordingly.

[0003]

As shown in FIG. 9, such a door opening and closing device includes: a drive motor 30 that is attached onto the upper surface of an upper frame 10 extending along the front width direction (the left-right direction in FIG. 9) of the entrance 7 of the elevator car 6; a reduction pulley 32 that is attached on one end side of the front of the upper frame 10 and has a larger diameter than a

motor pulley 31 attached to a drive shaft of the drive motor 30; a drive pulley 33 provided coaxially and integrally with the reduction pulley 32; a driven pulley 34 attached on the other end side of the front of the upper frame 10; a reduction belt 35 that is composed of an endless belt and is wound and hung around the
5 motor pulley 31 and the reduction pulley 32; and a 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.

[0004]

A door rail 11 is attached to the front of the upper frame 10. A pair of
10 rollers 13 attached to a door hanger 12 are placed on the door rail 11, and thereby the car door 8 is hung from the door rail 11 via the door hanger 12. In such a state, the car door 8 is coupled to the drive belt 36 of the door opening and closing device via the door hanger 12 and a coupling tool 37 attached to the door hanger 12.

15 [0005]

Accordingly, when the motor pulley 31 is rotated by the drive motor 30, the rotation is transmitted to the reduction pulley 32 via the reduction belt 35, and the drive pulley 33 is rotated together with the reduction pulley 32. This allows circulation of the drive belt 36, thus causing the car door 8 to reciprocate
20 along the door rail 11 via the coupling tool 37 and the door hanger 12, so that the car door 8 is opened and closed. The elevator shown in FIG. 9 has a configuration in which a pair of car doors 8 move respectively in opposite directions because one of the car doors 8 is coupled to one side of the drive belt 36, whereas the other of the car doors 8 is coupled to the other side of the drive
25 belt 36. That is, the elevator shown in FIG. 9 is a so-called center opening elevator in which the entrance 7 of the elevator car 6 is opened from its center.

CITATION LIST

Patent Literature

30 [0006]

Patent Literature 1: JP 2002-37574 A

SUMMARY

Technical Problem

[0007]

5 However, the above-mentioned conventional door opening and closing device has a problem that the total height of the elevator car 6 is large because the drive motor 30 is attached onto the upper surface of the upper frame 10. For solving such a problem, it is an extremely effective method to arrange the drive motor 30 so as not to project upward from the upper surface of the upper frame 10, specifically, to arrange the drive motor 30 on the front side of the upper frame 10 by attaching the drive motor 30 to the front of the upper frame 10, for example, via a bracket.

[0008]

 However, another problem is expected to occur in such a method. This problem occurs when a maintenance staff carries out maintenance checks for the elevator.

[0009]

 Generally, the maintenance staff carries out maintenance checks for the elevator by the following working procedures: entering the elevator car 6; switching the operation switch in the elevator car 6 to manual operation; and lowering the elevator car 6 down to a position such that the engaging portion 9 of the car door 8 and the engagement receiving portion 5 of the platform door 4 do not engage each other. Then, the maintenance staff opens the car door 8 and the platform door 4, and exits onto the platform 3. Next, after connecting a maintenance operation unit to a control unit provided above the elevator car 6, the maintenance staff presses a short-circuit switch of the maintenance operation unit so as to bring all the switches of the platform door 4 into a short-circuit state. Subsequently, the maintenance staff presses a down button in the maintenance operation unit so as to lower the elevator car 6 to a position that allows the maintenance staff to step on the elevator car 6 from the platform 3. In such a state, the maintenance staff detaches the maintenance

operation unit, steps on the elevator car 6, then connects the maintenance operation unit again, and thereafter carries out maintenance checks on instruments equipped inside the shaft 1 while operating the maintenance operation unit on the elevator car 6. Further, after finishing the work on the elevator car 6 or before starting the work, the maintenance staff carries out maintenance checks on the door opening and closing device from the position of the platform 3 with the platform door 4 open.

[0010]

Therefore, if the drive motor 30 is attached to the front of the upper frame 10 via the bracket in accordance with the above-mentioned method, the maintenance staff may use the drive motor 30 or the bracket as a foothold when stepping onto the elevator car 6 from the platform 3. In such a case, an excessive load is applied to the bracket so that the bracket is bent, and the drive motor 30 is tilted so that the axis of the drive shaft of the drive motor 30 (motor pulley 31) is displaced, which may possibly result in malfunction of the door opening and closing device.

[0011]

The present invention has been devised in view of the problems described above, and an object thereof is to provide an elevator door opening and closing device capable of suitably preventing a drive motor-bracket structure from being used as a foothold in maintenance checks on an elevator, even if a drive motor is attached to the front of an upper frame via a bracket for the purpose of reducing the total height of an elevator car.

25 Solution to Problem

[0012]

For solving the above-mentioned problem, the elevator door opening and closing device according to the present invention 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 is 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 the lower surface of the bracket.

5 [0013]

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

10 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.

[0014]

15 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.

[0015]

20 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.

[0016]

25 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 a horizontal direction orthogonal to the front of the upper frame, and the drive motor is attached to the lower surface of the bracket.

30

[0017]

According to such a configuration, the bracket has an inclined portion that is inclined with respect to a horizontal direction orthogonal to the front of the upper frame, and the drive motor is located below the bracket, thereby
5 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
10 bracket from being used as a foothold suitably.

[0018]

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
15 motor is attached onto the upper surface of the bracket.

[0019]

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, and
20 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.

25 [0020]

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
30 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.
[0021]

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
5 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

10 [0022]

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
15 elevator car, because the upper part of the drive motor-bracket structure is inclined.

BRIEF DESCRIPTION OF DRAWINGS

[0023]

20 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
25 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.

30 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

5 [0024]

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
10 conventional technique shown in FIG. 8 and FIG. 9 are denoted by the same reference numerals.

[0025]

First, the elevator according to this embodiment is schematically described with reference to FIG. 1 to FIG. 3. The elevator according to this
15 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
20 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
25 convenience of description.

[0026]

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
30 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
 5 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.

[0027]

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
 10 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.

[0028]

The reduction mechanism includes: an arm 15 that extends along the
 15 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
 20 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.

[0029]

25 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
 30 closed.

[0030]

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
5 closing of the car doors 8f and 8s.

[0031]

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;
10 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.

[0032]

The drive motor 30 is attached to the front of the upper frame 10 via a
15 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.

[0033]

20 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
25 maintenance performance, but also to reduce the man-hours or cost through the reduction in the number of parts.

[0034]

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
30 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).

[0035]

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.

[0036]

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.

[0037]

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).

[0038]

5 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).

10 [0039]

 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.

[0040]

 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.

[0041]

30 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.

[0042]

10 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.

[0043]

15 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.

[0044]

 According to such a configuration, the bracket 39 has the inclined portion 39b' that is inclined with respect to 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
5 42 can be enhanced.

[0045]

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
10 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.

15 [0046]

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
20 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').

[0047]

Further, in the above-mentioned embodiments, the bracket 39 is
25 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.

[0048]

30 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
5 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
10 foothold suitably.

[0049]

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
15 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.

[0050]

Further, the drive shaft of the drive motor 30 is directly connected with
20 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
25 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.

[0051]

Further, in the above-mentioned embodiments, the drive pulley 33, the
30 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.

[0052]

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.

[0053]

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

15 [0054]

- 1: Shaft
- 2: Entrance
- 3: Platform
- 4: Platform door
- 20 5: Engagement receiving portion
- 6: Elevator car
- 7: Entrance
- 8: Car door
- 9: Engaging portion
- 25 10: Upper frame
- 10a: Perpendicular portion
- 10b: Horizontal portion
- 11: Door rail
- 12: Door hanger
- 30 13: Roller
- 14: Bracket

	15: Arm	
	16: Reduction pulley	
	17: Reduction wire	
	18: Bracket	
5	19: Guide shoe	
	20: Car threshold	
	30: Drive motor	
	33: Drive pulley	
	34: Driven pulley	
10	36: Drive belt	
	37, 38: Coupling tool	
	39: Bracket	
	39a: Base	
	39b: Extending portion	
15	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
5 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
10 the drive motor is attached to a lower surface of the bracket.
2. The elevator door opening and closing device according to claim 1, wherein
the bracket is attached to the front of the upper frame so that an
15 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. An elevator door opening and closing device in which an openable and
20 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 a
25 horizontal direction orthogonal to the front of the upper frame; and
the drive motor is attached to a lower surface of the bracket.
4. 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
30 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

5. The elevator door opening and closing device according to any one of claims 1 to 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
10 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.

15